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IRIDESCENT CRYSTALS*

LABRODORITE, opal and mother-of-pearl are examples of naturally occurring substances which exhibit a play of colours. The present article deals with a different case, namely that of potassium chlorate. That crystals of this substance occasionally form with a tabular habit displaying a spectacular type of iridescence has long been known to those engaged in the manufacture of this chemical. The phenomenon came into prominence through the writings of the famous trio of British physicists of the nineteenth century, namely, Stokes, Rayleigh and Kelvin. Stokes was the first to make a serious study of the case and was led to recognise that the iridescence had its origin in the reflection of light at twin-plane boundaries within the crystal. Rayleigh developed a mathematical theory of such reflection; he came to the conclusion that a single twinned layer was insufficient to explain the observed effects and postulated that the iridescent crystals were polysynthetically twinned. In his Baltimore lectures, Kelvin drew attention to the interest of the case in relation to molecular tactics within a crystal and was led to speculate on the particular circumstances which led to the repeated twinning so frequently exhibited by potassium chlorate. Later observers have published some further observations, but the general complexion of the subject was left fundamentally unchanged. The present authors were led to undertake a study of the phenomenon by reason of the fact that a large collection of the iridescent crystals was at their disposal. Many new facts have emerged from these studies and they throw a fresh light on the theoretical aspects of the case.

By far the most interesting specimens are those crystals which indicate by their optical behaviour the possession of a high degree of regularity in their polysynthetic twinning. Such crystals exhibit sharply defined monochromatic bands when white light is incident nearly normally on them and the reflected light is viewed through a spectroscope. A careful

* From the Presidential Address by Sir C. V. Raman to the annual session of the Indian Academy of Sciences at Trivandrum.

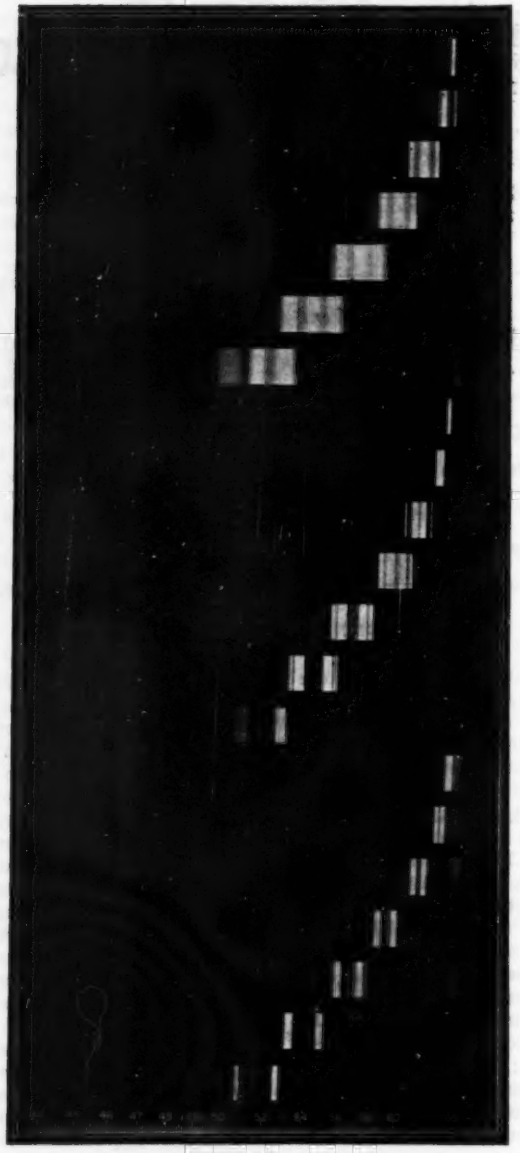

FIG. 1. azimuth 90°

FIG. 2. azimuth 30°

FIG. 3. azimuth 5°

Reflection Spectra of Potassium Chlorate

study of several such crystals has brought to light the fact that the spectral character of the reflections depends in a most remarkable manner on the azimuth of the plane of incidence of the light as well as on the obliquity of such incidence. This dependance is exhibited very clearly in the sequence of spectrograms reproduced in the accompanying Figs. 1, 2 and 3. Each of these figures shows a series of seven spectra with the angle of incidence increasing by steps of 10° from 5° to 65°. The spectra recorded in Fig. 1 refer to the case in which the plane of incidence makes an angle of 90° with the particular plane in which the coloured reflections totally vanish and which is also the plane of crystallographic symmetry common to all the elements of the twinned crystal. In Fig. 2 the plane of incidence makes an angle of 30° with the latter plane, while in Fig. 3 it makes an angle of only 5° with the same.

An examination of the spectrograms reproduced shows that when the azimuthal angle is small (Fig. 3), the sharply defined *single* monochromatic reflection recorded at nearly normal incidence splits into a *doublet* the components of which drift away from each other and also towards shorter wavelengths at increasing obliquities of incidence. On the other hand, when the azimuthal angle is 90° (Fig. 1), two new components make their appearance, one on either side of the central band, and their intensity increases progressively with increasing obliquity of incidence. The three components of the *triplet* thus produced drift towards shorter wavelengths and at the same time grow more diffuse. At intermediate azimuths (Fig. 2), the reflection spectrum consists of a *quartet* of lines due to the fact that while the central component splits into a doublet which widens as in the case of small azimuths, two additional outer components also make their appearance as in the case of an azimuthal angle of 90°, though with smaller intensities than in the latter case. The whole situation may be thus summarised by the statement that the spectrum of the reflected light is, in general, a *quartet* of lines; at nearly normal incidence, the outer components are of vanishingly small intensity and the central components are an unresolved doublet, thus resulting in what appears as a *single* monochromatic reflection. When the azimuthal angle is small, the outer components have vanishingly small intensity for all incidences and the spectrum is therefore seen as a *doublet*. On the other hand, when the azimuthal angle is 90°, the outer components have a notable intensity while the inner components are unresolved, thereby giving us a *triplet*.

Standing in the closest relation to the spectral behaviour of the reflected light are the states of polarisation of its spectral components revealed by our studies. It has been observed that both the components of the doublet reproduced in Fig. 3 are *plane-polarised* but in opposite ways. Further, and provided that the angle of incidence is not too large, the outer components of the triplet in Fig. 1 also exhibit *plane polarisation* but in a different way from the doublets appearing in Fig. 3. The central component of the triplet in Fig. 1 is however always *unpolarised*. The quartet of lines recorded in Fig. 2 exhibits in respect of the two outer components the same features of polarisation as in Fig. 1, while those of the inner components correspond to those in Fig. 3. A further interesting observation is that when the crystal is rotated in its own plane about the normal, the angle of incidence being kept constant, the two central components of the quartet approach each other and after coinciding when the azimuthal angle is 90°, separate again. The unpolarised state of the central component in Fig. 1 is thereby revealed merely as a consequence of the overlap of two components polarised in perpendicular planes.

The whole group of phenomena set forth above finds a natural explanation when we consider *firstly*, the division of an incident beam of unpolarised light into *two beams* polarised in perpendicular planes when it enters the birefringent crystal; *secondly*, the character of the reflection which each of these beams suffers when it meets the twin-plane boundaries inside it, and *thirdly*, the propagation of the beams of light thus reflected within the crystal before their final emergence from it. In general, corresponding to *each* of the two pencils into which the incident beam divides on entry, we have *two* differently polarised sets of beams reflected at the regularly-spaced twin-plane boundaries. Hence, the light emerging from the crystal consists of *four* different sets of beams the retardations suffered by which are in general different from each other. It follows that there would, in general, be four sets of sharply-defined maxima in the spectrum of the light reflected by the regular stratifications of the crystal. The reduction of the quartet of lines thus expected on theoretical grounds to a singlet, a doublet or a triplet as the case may be, depending on the azimuth and obliquity of incidence are

derivable as consequences of the special circumstances of each case. For instance, when the azimuthal angle is small, one of the two reflections in each case vanishes and the quartet reduces to a doublet. If, in addition, the angle of incidence is also small, the light paths corresponding to the two surviving sets of beams differ inappreciably and we observe a single sharply defined monochromatic band in the spectrum. *Per contra* when the azimuthal angle is 90° and the incidence is sufficiently oblique, all the four sets of reflected beams have to be considered, but by reason of the symmetry of the case the paths for the two middle components continue to be identical and hence we observe a triplet. The explanations indicated above are completely substantiated by the observed states of polarisation of the components in each case taken in conjunction with the known characters of the birefringence of the crystal.

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D. KRISHNAMURTI.

NOBEL AWARD FOR MEDICINE, 1952

DR. SELMAN A. WAKSMAN, Professor of Soil Microbiology at Rutgers University, New Jersey, has been awarded the 1952 Nobel Prize for Medicine, for his discovery of streptomycin. His interest in the chemistry of living processes began many years ago in Russia—he was born in the Ukraine in 1888—and by 1915, five years after his arrival in the U.S.A., he had already undertaken a study and classification of the actinomycetes. His investigations were mainly agricultural until 1939, when Rene Dubos, who had been one of Waksman's students at Rutgers University, isolated from a spore-bearing soil bacterium, a substance (gramicidin) which appeared to be capable of destroying pathogenic bacteria. About this time also Gleming's discovery of the anti-bacterial action of penicillin was being developed for therapeutic purposes, and Waksman turned his full attention to an attempt to isolate from the soil micro-organisms possessing anti-biotic properties. It was early in 1944 that with Schatz and Bugie he announced the isolation from *Streptomyces griseus* of streptomycin, a substance antagonistic to both gram-negative and gram-positive bacteria including *Mycobacterium tuberculosis*. The fact that streptomycin was the first effective anti-biotic to be used in the treatment of tuberculosis has become a part of medical history. One of its most notable successes has been in tuberculous meningitis, no longer an invariably fatal disease.

Streptomycin has well-known limitations, among them its toxic effect on the eighth nerve and the development of resistance by tuberculosis bacilli. In reviewing the possibility of further advances in this field, Dr. Waksman wrote in the *British Medical Journal* two years ago: "Sooner or later other anti-biotics will be found which are more effective than either (streptomycin and neomycin) and less toxic. The fact that in the various surveys on anti-biotic production by micro-organisms the acid-fast bacteria are found to be among the most sensitive forms points to the possibility of the existence of such agents. Finding these is merely a matter of further search".

(—By courtesy of the *British Medical Journal*)

THEORY OF EARTH'S INNER CORE

FOR some years it has been known that the earth contains a central core with a radius of 2,200 miles. This central core is physically distinct from the outer mantle, which extends up the further 1,800 miles to the earth's surface. Several distinct lines of evidence have pointed to the bulk of this central core being in a fluid state. Over the years from 1935 to 1939, it was concluded that the central core contained an inner core with a radius of about 800 miles. Professor Bullen, Professor of Mathematics at Sydney University, Australia, has recently adduced some evidence to the effect that while the outer part of the central core is fluid, the inner core is solid, with a density of about 18 times that of water. There is some division of opinion on the question of the composition of the outer part of the central core, but his work favours the view that the central core consists of a high density liquid form of silicate rock with a density about 11 times that of water, and that the inner core is chemically distinct and consists of iron, nickel and probably some denser metals.

LATE PRE-CAMBRIAN GLACIATION IN CENTRAL INDIA

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IT is a well-known fact that at the end of the late Pre-Cambrian period there occurred a widespread ice age. Nantow Tillite of China, the extraordinarily thick glacial series of Adelaide System in Australia, and the extensive tillite of Numees Series in South Africa are eloquent proof of glaciation in the immediate vicinity of India while later Pre-Cambrian tillites are quite as well developed and have been reported from Norway, Scotland, Spitzbergen and from many localities in North America. In India, Sir Thomas Holland sugested in 1908 that Blaini conglomerate as found near Simla may be much older than the Permo-Carboniferous and may belong to Late Pre-Cambrian glaciation. The Blaini conglomerate is now relegated to the Permo-Carboniferous age by most people in spite of the fact that the succeeding Krol Series is totally devoid of fossils.

The senior author, while mapping the Son Valley in 1948 observed that the basal bed which marks the lowermost horizon of Lower Vindhyans and overlies the Bijawar Series, was composed of a fine-grained siliceous rock, in which are distributed angular and sub-angular boulders of vein quartz varying in size upto a maximum of 9", as well as subordinate amounts of jasper and trap pebbles. This horizon extends for nearly 100 miles between River Banas and River Gopath, the two tributaries of River Son. It was thought that such boulders might have been the result of torrential action. But the unassorted assemblage, combined with great extension, suggested the possibility of glacial action. This boulder bed merges into a coarse-grained quartzite at the top. The matrix on examination under a microscope reveals the presence of abundant flesh-coloured fresh feldspars. The presence of feldspar strengthened the belief that ice has led to the formation of such a deposit. It is interesting to note that Oldham[1] also has described a similar rock occurring between River Banas and Gopath which he thinks 'is in fact an indurated boulder clay of a structure similar to the glacial boulder clays of Europe and the Talchir boulder clays'.

The junior author while working in Bundelkhand in Ken Valley in 1950 (Map Ref. No. 54.P/14) found that just below the Semri Series and overlying the Bijawars, there is a remarkable formation of 150' thickness which forms the most prominent scarp in the locality. It consists of a totally unstratified clay of chocolate brown colour in which are embedded pieces of varied lithology—sandstones, quartzites, conglomerates, cherts and traps, representing the Bijawar Series and granite pieces

FIG. 1. Angular and sub-angular rock fragments of all grade embedded in a dark argillaceous matrix (Unassorted breccia of sporadic fragments). Note the unstratified nature of the deposit. Locality Ken Valley

FIG. 2. Big boulders, angular and sub-angular, embedded in a dominant dark matrix. The boulder (block) in the fore-ground is of quartzite and measures 3 feet across. Field photo of the Tillite occurring in Ken Valley.

derived from Bundelkhand granite. These sparsely enclosed constituents display most remarkable variation in size and shape. Boulders and blocks measuring 3' across are not uncommon, while every grade down to silt size is represented. They are angular and subangular in shape. Under the microscope, angular fragments of rock types mentioned earlier are seen embedded in a ferruginous matrix. This formation with its peculiar characters extends to 20 miles towards west.

The extreme variation in grain-size, the dominance of argillaceous matrix, and a lithological assemblage derived from distant localities combined with the great thickness and lateral extent, strongly suggest that the deposit is a typical tillite.

It will be found that the horizon of this boulder bed in Bundelkhand is the same as that of the boulder bed of Son Valley, being situated at the bottom of the Semris and at the top of the Bijawars. The shortest distance between the two areas is about 150 miles and the glaciation seems to be fairly extensive in scale.

This study indicates that India did not escape the late Pre-Cambrian glaciation which affected the neighbouring regions such as Australia, China and South Africa. Considering the principle of universality of great ice ages and also allowing for the fact that the precise datum is not obtained by comparing the evidences of glacial action in distant countries we have to reconsider the conventional position of Vindhyans. They may be younger than what they are believed to be.

1. Oldham, R. D., "Geology of Son Valley in Rewah State and Part of Jabbalpur and Mirzapur," *G. S. I. Mem.*, 1901, **31**, Pt. 1, 41.

SCIENTIFIC SPIRIT IN ANCIENT INDIA*

THE development of a rational attitude of mind and a spirit of inquiry into the mysteries of the universe, which form the basis of all scientific study, is rightly claimed to be one of the greatest legacies of Greece to humanity. As in Greece, so in India, speculative philosophy was followed by a true scientific inquiry based on close observation of facts and phenomena. The method of science, which has been described fully in Indian literature, involves, among others, perception, observation, experiment, inference and hypothesis. By application of this method great advances were made in astronomy and medical science including anatomy and surgery. These led to the growth of other sciences such as mathematics and chemistry. The actual achievements of the Hindus in these branches of science were very great and compare favourably with those of any other ancient people.

Even in other branches such as botany, zoology, mineralogy, metallurgy and physics, where actual attainments were not as great, we find the scientific process at work, *viz.*, observation and classification of phenomena, experiment and inference. As regards botany, reference may be made in particular to the classification of plants, treatment of seeds for successful germination, study of diseases of trees and the method of improving flowers and plants—even to the extent of changing their essential properties. More striking is the detection in plants of the phenomena of life and death, sleep and waking consciousness, of pleasure and pain, sensitiveness to heat and cold, and movements towards what is favourable and away from what is unfavourable. In zoology we find various classifications of animals on the basis of their *vija* (ovum or seed), the number of senses possessed by them and according to their habitat, mode of life and dietary value. In mineralogy and metallurgy we have reference to the working of underground mines, manufacture of various metals and a scientific process of treating metals. The iron pillar of Delhi is a living testimony to the forging of iron on a scale unknown to recent times and the process, now forgotten, of evolving a type of iron which does not rust in 1,500 years. The true nature of gems and their classifications show some knowledge of geology.

The study of ancient Indian science is yet in its infancy, and if India suffers in this respect in comparison with Greece and other countries, it is perhaps due more to our ignorance than to her actual backwardness, either in scientific spirit or in actual achievements in various branches of science.

* From the 14th Sir J. C. Bose Memorial Lecture, delivered by Dr. R. C. Mazumdar at the Bose Institute, on 30th November 1952.

ACTION OF DIETHYLAMINOETHYLPHENOTHIAZINE (2987 RP, DIPARCOL) AND MYANESIN ON TONE AND REFLEX REGULATING CENTRES OF THE NERVOUS SYSTEM

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THE mode of action of drugs used for the treatment of Parkinson's disease in man is not fully understood yet. It is now assumed that the nicotinolytic action of these drugs bears some relation to their therapeutic activity.[1] However, it seems desirable to work out more detailed information on the pharmacology of these substances.

For that purpose experiments were carried out on cats, using a method which proved to be of value in the determination of the action of drugs on interneurons of the Central Nervous System:[2,3] the animals were anesthetised with either Dial (0·5 c.c./kg. of the commercially available solution, intraperitoneal†) or with Chloralose (80 mg./kg. intravenous). The knee jerk was elicited at regular intervals (every 10 sec.) with an automatically driven hammer.[4] Electrodes, covered with insulating material except for the tip, were inserted into the brain stem using a simplified Horsley-Clark instrument. For unipolar stimulation rectangular impulses of a frequency 100 per sec were used. According to the site of stimulation, three different types of effects could be observed in these experiments during the period of central stimulation: inhibition and facilitation of the knee jerk as known from the work of Magoun, *et al.*, were most frequently encountered. Occasionally a hypertonus of the quadriceps muscle with repetitive components or clonus following each reflex contraction was observed as the result of the stimulation. The rise of tone was usually not accompanied by any alteration of the tension developed by the phasic reflex. These effects lasted only for the period of actual stimulation, usually ½ to 1 minute. The drugs were injected intravenously. The position of the electrode was verified at the end of the experiment macroscopically. The points which on stimulation gave facilitation or inhibition of the phasic reflex contraction coincided with the regions indicated by Lindsley, Schreiner and Magoun,[5] i.e., basal diencephalon, pontile tegmentum, certain parts of the bulbar reticular formation and lower reticular formation respectively. When rise of tone was observed, the tip of the electrode was always found to be situated near the vestibular nuclei in the medulla.

In these experiments the action of Diparcol‡ as a representative for anti-Parkinson drugs was compared with the well-established action of Myanesin.[2,3] If Diparcol was injected in a dose of at least 20 mg./kg., a block of the interneurons involved in the facilitation or inhibition of the monosynaptic test reflex (i.e., knee jerk) could be observed. Following the injection of such a dose (usually given in at least two portions, each 10 mg., at an interval of 5 minutes), the inhibition as well as the facilitation of the knee jerk, on stimulation of the appropriate points in the brain stem, became gradually reduced and finally disappeared completely. Fig. 1 gives an example of the action

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† Ciba Ltd., Bale

‡ We are obliged to Specia, Paris, for kindly supplying the compound.

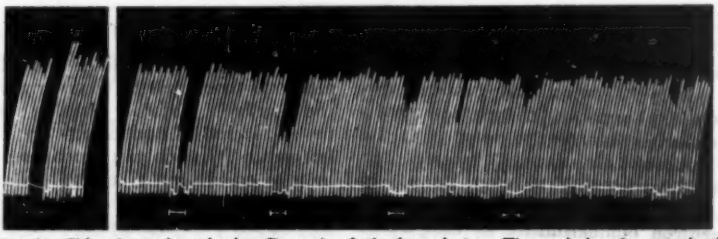

FIG. 1. Cat in Chloralose Anesthesia. Record of the knee jerk. The periods of central stimulation are indicated at the bottom of the record. 20 mg./kg. Diparcol were injected intravenously between the first and the second part of the figure. The injections were given in 10 mg./kg. doses, at an interval of 5minutes. The right part of the record starts with the end of the second injection.

of Diparcol on the centrally induced reflex inhibition. In doses below 20 mg./kg., Diparcol was regularly without any significant effect on central facilitation and inhibition respectively.

In the action described so far, Diparcol resembles Myanesin closely,[6] which also abolishes the effect of facilitory and inhibitory stimulation of the brain stem. The striking fact noticed was when the effects of central stimulation of the reticular formation resulted in hypertonicity of the extensor muscles, Diparcol in as low a dose as 5 mg./kg. completely abolished the tonic effect without appreciably interfering with the phasic reflex (Fig. 2). This effect of Diparcol lasted in different experiments from 20-40 minutes. In one instance (*cf.* Fig. 2), a small facilitation of the phasic reflex became even manifest at a time when the tonic contraction of the quadriceps muscle due to central stimulation was completely suppressed by Diparcol.

Experiments were then performed to demonstrate whether such a difference in the sensitivity of tone- and reflex-regulating areas in the brain stem exists also for Myanesin. In two experiments performed for that purpose, we observed that Myanesin also in a dose of 5 mg./kg. abolishes any centrally induced tonic response. For the blockade of central inhibition and facilitation of the knee jerk however, at least 25-30 mg./kg. have to be administered in cats.

On the basis of these observations, we come to the conclusion that the centres of the reticular formation influencing the tone are considerably more susceptible to the paralysing action of interneuron blocking drugs such as Myanesin and Diparcol, than the reflex regulating centres. This observation corresponds well to the clinical experience, indicating that the increased muscle tone in disorders of the extrapyramidal motor system is particularly reduced by Diparcol.[7]

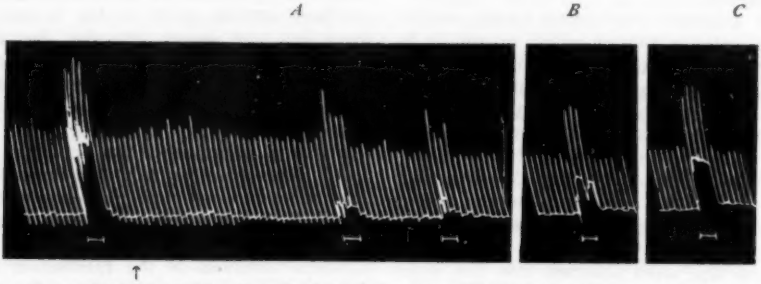

FIG 2. Cat in Dial-Anesthesia. Record of the knee jerk. White marks indicate the periods of stimulation. At the arrow 5 mg./kg. Diparcol are injected intravenously. Record B demonstrates the effect of central stimulation 25 minutes after the injection, record C 40 minutes after the injection of Diparcol.

1. Bovet D. and Longo, V. G., *J. Pharmacol.*, 1951, **102**, 22. 2. Kaada, B. R., *J. Neurophysiol.*, 1950, **13**, 89. 3. Henneman, E., Kaplan, A. and Unna, K., *J. Pharmacol.*, 1949, **97**, 331. 4. Schweitzer, A. and Wright, S., *J. Physiol.*, 1936, **88**, 459. 5. Lindsley, D. E., Schreiner, L. H. and Magoun, H. W., *J. Neurophysiol.*, 1949, **12**, 197. 6. Berger, F. M., *Brit J. Pharmacol.*, 1947, **2**, 241. 7. Bovet, D. and Bovet-Nitti, F., *Medicaments du systeme nerveux vegetatif*, *Bale*, 1948, *cf.* p. 616.

ATOMIC FURNACE FOR DETECTION OF IMPURITIES

A NEW and highly accurate method of using atomic energy to detect and measure impurities in foods, pharmaceutical producs, metals and other materials has been developed at the Oak Ridge National Laboratory, Tennessee. The technique involves placing the test sample in a graphite reactor or 'atomic furnace', and exposing to neutron bombardment, so that traces of impurities will be rendered radio-active. Highly sensitive instruments and detectors are then used to measure the exact quantities of impurities present. This is possible because the elements to be tested, when irradiated, produce radio-active isotopes having characteristics never exactly duplicated by other radio-isotopes. This analysis technique, which should help to ensure purity of the manufactured product, is now being offered to industrial, scientific and medical organisations in other countries, by arrangement with the U.S. Atomic Energy Commission.

LETTERS TO THE EDITOR

ON THE LAKI BEDS IN DHARMPUR SUBATHU REGION, SIMLA HILLS

MEDLICOTT[1] recognised the Subathus, but he included therein the overlying Dagshais and Kasaulis as well. In the first edition of the *Manual of Geology* (1879), however, the name Subathu was restricted to the oldest members of the sequence and the whole connected strata were designated as Sirmur series. According to Auden,[2] in the Solon-Subathu region, the Dagshai and Subathu rocks rest upon Simla slates and have been overthrust by rocks of the Krol Nappe.

During the course of two brief visits to Dharmpur (30° 54′ N.: 77° 1′ 30″ E.) during the months of April and August 1952 and one to Subathu (30° 58′ N.: 76° 59′ 45″ E.) I made collections of the Subathu rocks from a number of fossil localities. Examination of rock sections has revealed the following fauna: *Assilina granulosa, A. spinosa, A. leymierie, A.* cf. *mamillata, A.* cf. *dandotica* and others; *Nummulites atacicus, N. globulus, N.* cf. *mamilla*; *Lockhartia* sp., *Rotalia* sp., *Quinquiloculina* sp. and other smaller foraminfera.

Vredenburg[3] stated that the Subathus were the equivalents of Kirthars. Pinfold[4] brought their lower age limit down to Lakis but Pilgrim and West[5] restored the Subathu series to Middle Eocene and stretched the Uppermost Subathu beds to Upper Oligocene.

The presence of *A. granulosa, A. spinosa, A. leymierie* and *N. atacicus*, as noted above, stamps these sediments as Laki and the absence of *N. irregularis* and *N. subirregularis* is indicative of Middle Laki. *N. irregularis* is confined to Lower Laki and has not hitherto been reported from the Upper Laki in the Indian region. No Kirthar foraminifera were noticed in the area studied.

A more detailed account of the work will be published elsewhere.

I am deeply indebted to Prof. S. R. Narayan Rao, whose kind guidance has made this work possible.

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Lucknow University,
Lucknow,
September 3, 1952.

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AUTHIGENIC TOURMALINE FROM THE SATYAVEDU STAGE (UPPER GONDWANAS) NEAR MADRAS

IN the course of a further examination of the heavy mineral assemblages of the Sriperumbudur and the Satyavedu stages[1] a number of well-rounded detrital tourmaline grains with jagged overgrowths of authigenic tourmaline were noticed in the Satyavedu stage. These are not seen in the Sriperumbudur stage. Nearly 17 per cent. of the total number of these detrital tourmaline grains have overgrowths of authigenic tourmaline, the overgrowths averaging to about 22 per cent. of the size of the original grains, the largest overgrowth being 0·10 mm. in length. These are illustrated in the accompanying photo-micrographs (Figs. *a* to *e*). In each of these grains, the authigenic portion has a slight tinge of the same colour as the host grain and is in complete optical continuity with the host as evidenced by identical position of maximum absorption and simultaneous extinction. Further, the authigenic overgrowth is seen only at one end of the "c" axis of the host grain irrespective of its elongation. According to Alty[2] the authigenic overgrowths on tourmaline occur at that end of the "c" axis which is the antilogous pole of the mineral.

In each of the grains with authigenic overgrowth here is a zone of roots or reorganisation clearly seen between the authigenic portion and the host grain where the two are welded together (Fig. *e*). This zone of roots or reorganisation, according to Krynine,[3] "is characterised by pitting and etching of the nucleus with roots of the overgrowths entering these pits".

Detrital tourmaline grains with overgrowths of authigenic tourmaline have been reported by Stow, Martens and Krynine[4] respectively from the Lower Devonian, Lower Silurian and Upper

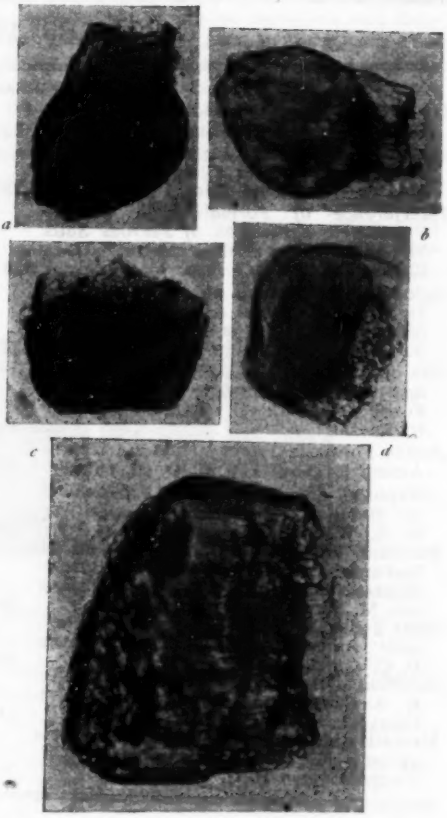

FIG. 1. Photomicrographs showing detrital tourmaline grains with overgrowths of authigenic tourmaline from the Satyavedu stage (Upper Gondwanas) near Madras.

a. A well-rounded grain set in the position of maximum absorption; the 'c' axis coincides with the elongation of the grain and the authigenic portion occurs at one end of the 'c' axis. × 120.

b. Same as *a*, set in the position of minimum absorption. × 120.

c. An oval grain set in the position of maximum absorption; the 'c' axis lies across the elongation of the grain and the authigenic portion occurs at one end of the 'c' axis. × 120.

d. Same as *c*, set in the position of minimum absorption. × 120.

e. An oval grain set in the position of minimum absorption to show the zone of roots or reorganization between the authigenic portion and the host grain. ×120.

Cambrian formations of the central part of the Appalachian geosyncline; the present paper records such an occurrence for the first time in India. According to Krynine such occurrences are restricted to thin stratigraphic horizons over wide areas and are thus of correlative value. In the present case, it is interesting to note that detrital tourmaline grains with overgrowths of authigenic tourmaline are found only in the sediments of the Satyavedu stage and not in the Sriperumbudurs. This feature may be used in distinguishing between these two sets of coastal upper Gondwanas, and in identifying and correlating stray and local exposures of the Satyavedu stage.

The writer is thankful to Prof. L. Rama Rau and Sri. M. R. Srinivasa Rao for their valuable guidance and to Sri. M. M. Veerabhadraiah for assistance in photomicrographic work.

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Central College,
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October 27, 1952.

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INTERFERENCE OF FORMALDEHYDE IN THE VOLUMETRIC ESTIMATION OF FERROUS SALTS

IT has been shown by Gopala Rao, *et al.*, that alcohols, sugars, etc., interfere in the volumetric estimation of ferrous salts by potassium dichromate. Experiments now carried out show that formaldehyde behaves similarly. It is found that when a drop of potassium dichromate solution is added to an aqueous solution of formaldehyde, containing sulphuric acid, phosphoric acid and a suitable redox indicator like diphenyl benzidine, the color of the oxidized form of the indicator is immediately produced, showing that the direct reaction between formaldehyde and dichromate is very slow. But in the presence of ferrous salt, the reaction between formaldehyde and dichromate is induced by the reaction between ferrous salt and dichromate. We have also found that ferrous salt does not induce the reactions between formaldehyde and ceric sulphate or formaldehyde and sodium vanadate. Hence we recommend the use of ceric sulphate or sodium vanadate for the estimation of ferrous salts in the presence of formaldehyde.

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Waltair, G. GOPALA RAO.
August 4, 1952.

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INFLUENCE OF FREEZING ON THE VOLUME OF JUICE EXTRACTED AND ASCORBIC ACID CONTENT OF CERTAIN FRUITS

IN quick freezing[1] though destruction of cell structure is avoided,[2,3,4] the cells are killed out. Fruits kept at — 20° F. for two days become as hard as stones and a few hours after removal from this temperature, they are so soft as to render a fair amount of the juice being squeezed out by hand pressure.

Studies were carried out by extracting the juice from amla, kept at — 20° F. for 48 hours as also those at room temperature for the same period, in a hydraulic press employing the same pressure for both the samples. It was found that quick frozen material yielded about 12 per cent. more juice. It was of interest to determine the ascorbic acid content of the juice.[5] The results (Table I) show that more ascorbic acid is recovered as a result of getting more juice from the frozen amla, while the concentration of ascorbic acid in both the juices is practically the same, showing thereby that freezing does not involve any dilution of the juice. The observations carried out with other materials are recorded in Table I.

TABLE I

Fruit	Temperature of storage	% increase in volume of juice	Excess of ascorbic acid obtained over that kept at room temperature in mg. per 100 g.
Mango	— 20° F.	20·8	6·65
Cashew apple	— 20° F.	14·0	42·6
Amla	— 20° F.	12·0	49·6
Lemon	— 20° F.	14·0	5·86
Orange	— 20° F.	19·0	14·50
	20° F.	16·0	9·04
	Refrigerator temperature	8·0	4·94

In the case of oranges, kept at varying temperatures, a progressive increase in the volume of juice was obtained, the values for total

ascorbic acid following the same trend. This would appear to be due to the destruction of the cells which are primarily responsible for the resistance offered when the juice is extracted.

The studies reported here have some practical significance. A greater volume of juice coupled with increased vitamin C could be obtained by quick-freezing the material prior to extraction of juice. It might indeed be worthwhile to try this method in the case of sugarcane, to see whether it would be possible to obtain more juice and proportionally more sugar from the same tonnage of sugarcane.

Further work on some other aspects concerning freezing to — 20° F. is in progress.

The authors are indebted to Dr. K. V. Giri for his keen interest in the progress of the investigation.

Food Technology Lab., P. B. Rama Rao.
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Indian Inst. of Science, R. Rajagopalan.
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USE OF AMMONIUM MOLYBDATE AS A CATALYST IN THE IODOMETRIC ESTIMATION OF FERRIC IRON

Ammonium Molybdate was used as a catalyst[1] in the hydrogen peroxide-iodide and bromate-iodide reactions by Kolthoff and co-workers. The dichromate-iodide reaction was also shown to be catalysed[2] strongly. In the present work, we studied the iodometric estimation of iron and found that ammonium molybdate does catalyse the reaction :— $2Fe^{+++} + 2I^- \rightarrow 2Fe^{++} + I_2$.

The reaction was complete in 10 minutes using 3 drops of the catalyst; also immediately with 8 or more drops of the catalyst. The estimated amount of iron by this method is the same as that obtained by using cuprous iodide as catalyst or by reducing the trivalent iron to divalent stage and titrating it with either standard permanganate or dichromate solutions. Since it is troublesome to prepare cuprous iodide or to reduce ferric salt to ferrous stage, the quickest as well as an accurate method is to take 25 c.c. of ferric (equivalent to about 0·14 gm. of iron) salt in solution (not containing much acid) in a stoppered bottle, add 10 c.c. of 2 N HCl, 10 c.c. of 10% $NaHCO_3$, 8 drops of 20% aqueous ammonium molybdate, 25 c.c. of 12% KI solutions and to titrate with standard thiosulphate.

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September 3, 1952.

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AMIDE FORMATION FROM ACIDS AND UREA

Cherbuliez and Landolt[1] have described a new general method for the preparation of amides from urea and acids. The present work was undertaken with a view to investigate, in a systematic manner, the application of the method to different classes of acids. Besides saturated monobasic acids including substituted ones, unsaturated and dibasic acids have been tried and the results indicate that, in this method, the presence of any such functional group as will facilitate the formation of a 5- or 6-membered ring, hinders the formation of amides. Propionic, butyric, palmitic and stearic acids, all give the amides in good yield. Further, while diphenyl acetic acid gives the amide (70-80% yield in different batches), which when crystallised from benzene melts at 170-71° (167-68°, highest reported in the literature), diphenyl chloroacetic acid and diphenyl glycollic acid both yield diphenyl hydantoin (formation of a 5-membered ring). In the dibasic acid series, succinic acid yields the imide (both with one and two moles of urea) and adipic acid gives the diamide. Malonic acid fails to give the amide; the resulting product melts with decomposition above 360° C., dissolves in hot water and in alkali solution and is reprecipitated on acidification. It may probably be malonyl urea. Cinnamic acid is reported to give with urea, 4-phenyl-hydrouracil.[2] Besides this compound, another product, m.p. 220-22 (alcohol) has now been isolated from the reaction product of cinnamic acid and urea. Phenyl and diphenyl urea (sym.) have also been used in place of urea and give with diphenyl acetic acid, N-phenyl diphenylacetamide.

An example of the non-formation of amide form urea and acids consequent on the facile formation of a 5-membered ring is afforded by the reaction between benzilic acid and urea first studied by Biltz,[3] who obtained 5 : 5-diphenyl hydantoin (45% yield) by their interaction at

elevated temperatures. Sikdar and Ghosh[4] obtained it in about 44% yield. None of these workers, however, give any account of the low yield of the above compound. The present authors have isolated besides 5 : 5-diphenylhydantoin, two additional products, one melting at 153-54° and the other at 269-70°, both containing nitrogen, from the final product of the reaction between benzilic acid and urea at 220-30°. The reaction mass was treated with alcohol and benzene and separated into three crystalline products. It was noted that after the extraction of the resulting mass by aqueous caustic soda, a residue was left behind of which neither Biltz nor Sikdar and Ghosh have made any mention. This residue was further worked up and the two additional products were obtained. The products, m.p. 153-54° and m.p. 269-70°, showed considerable depression of the melting point on admixture with authentic samples of benzilic acid amide (m.p. 153-54°) and 5 : 5-diphenyl hydantoin (m.p. 286°), respectively. These compounds which appear new, have been subjected to degradation and the work on their characterisation now in progress, will be published later on.

The authors wish to express their thanks to their colleague, Dr. M. A. Aziz, for helpful suggestions.

Dept. of Chemistry, Azizur Rahman.
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β-NAPHTHYL SULPHIDE AS SPOT TEST REAGENT FOR METALLIC RADICALS

In our attempts to use metallic chlorides as chlorinating agents in connection with some other work on hand, it was found that when an alcoholic solution of 2-2′-dihydroxy-dinaphthyl sulphide[1] (m.p. 212° C.) was treated with cupric chloride, a red compound (m.p. 158° C.) was obtained which retained sulphur, contained copper but no chlorine. Since the formation of this compound was practically immediate, it led to an examination to see what other common metallic radicals would respond to this sulphide by giving colour reactions. It was found that silver nitrate, lead nitrate, mercurous nitrate, bismuth trichloride, ferric chloride, manganese chloride, cobalt chloride gave precipitates which had light chocolate, pale yellow, pale brown, white, dark buff, flesh and grey colours respectively.

Pieces of filter-paper were spotted with one per cent. acidic solutions of salts of copper, bismuth, iron, manganese, silver, mercury and cobalt when it was found that, after exposure to ammonia, about one per cent. alcoholic solution of the sulphide gave immediate colour reactions as follows: Silver nitrate—greenish yellow; Mercurous nitrate—dirty yellow; Ferric chloride—yellow; Copper chloride—"copper" colour.

The conditions necessary for the complete precipitation of metallic radicals using this reagent and the use of the latter in chromatographic identification and estimation of these radicals will be published elsewhere.

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July 14, 1952.

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NUTRITIVE VALUE OF THE SEED PROTEINS OF *SESBANIA GRANDIFLORA* PERS.

The seeds of *Sesbania grandiflora* Pers. (Vern.: Agathi, Agasti, Agase) have been reported to contain 68% protein,[1] perhaps the highest on record among vegetable seeds. In view of the possible use of a material so rich in protein to supplement the poor Indian diets, its nutritive value was studied.

The percentage composition of the husked seeds—freed from the tough seed-coat as well as the inner membrane—was as follows: Moisture 7·5, ether extractives 4·2, protein 69·9, ash 4·5, calcium 70 mg. The flour prepared from these seeds was used as the source of protein in the biological tests.

The protein efficiency ratio was determined in weanling rats (groups of 8 each) and the digestibility coefficient and the biological value by the nitrogen balance method in adult rats (6 males weighing 180-200 g.) at 10% level of protein in adequate synthetic diets. As the protein by itself did not support growth—most of the experimental animals lost 2-3 g. in body weight in 3 weeks—the effect of supplementing the protein with casein in various proportions, as also of autoclaving it (30 minutes at 15 lb. steam pressure) was studied.

TABLE I

Biological value of the seed proteins and the effect of supplementation with casein

Protein	Protein efficiency ratio (6 week period)	Digestibility coefficient	Biological value (Nitrogen balance)
1 Casein ..	1·96±0·05	95·5±0·67	64·5±1·57
2 Sesbania protein	Nil	92·4±1·89	35·6±1·88
3 Casein : Sesbania protein (2 : 1)	1·74±0·07	..	..
4 Casein : Sesbania protein (1 : 1)	1·36±0·14	93·4±1·20	45·6±1·65 50·05 (calculated)
5 Casein : Sesbania protein (1 : 2)	1·11±0·13	..	..
6 Autoclaved Sesbania protein	..	89·0±1·30	35·9±1·85

It is evident that the seed proteins have a low biological value which does not improve on wet-heat processing. In the proportion of 1 : 1, the seed proteins and casein, at a dietary protein level of 10%, do not exhibit any supplementary relationship in respect of their biological values. With regard to growth, however, the two proteins in the several proportions examined exert a significant supplementary effect. But this supplementation is of a low degree, for, even when the dietary protein is made up of a high proportion of casein, its protein efficiency is significantly lower than that of casein itself.

The effect on the growth of weanling rats (groups of 6 each) when the seed flour replaced the tur dhal, as also part of the rice in the conventional poor rice diet[2] was determined over a 6-week period.

TABLE II

Effect of substitution of Sesbania seeds in the poor rice diet

Diet	Average intake (g. per rat)		Growth (g.)
	Food	Protein	
1 Poor rice diet (5 parts tur dhal, and 78 parts rice)	290·4	31·2	33·0±0·92
2 Poor rice diet (5 parts seed flour and 78 parts rice)	384·4	39·9	23·6±0·84
3 Poor rice diet (10 parts seed flour and 73 parts rice)	288·2	37·2	26·0±1·37
4 Poor rice diet (20 parts seed flour and 63 parts rice)	256·4	47·2	16·7±3·59

Obviously the replacement of even the 5 parts of tur dhal in the rice diet markedly depresses growth but does not appreciably affect food intake. On further replacing the rice with increasing proportions of the seed material, there is an increasingly adverse influence on both appetite and growth, in spite of the enhanced protein content of the diets as well as the protein intake. Thus, even partial substitution of the seeds in the rice diet has a deleterious effect on its over-all nutritive value. There is a substantial reduction in the food intake of animals in Group 3 as compared to Group 2, but the growth rates are not significantly different presumably because the total protein intake is nearly the same in the two groups.

The trend of the results indicate that the seed proteins belong to the class of incomplete proteins which are grossly deficient in one or more essential amino acids. Preliminary paper chromatographic examination has revealed that the protein is deficient in lysine and the sulphur amino acids. The complete amino acid make-up of the protein is under study.

We are grateful to Dr. V. Subrahmanyan, Director of this Institute, for his kind interest in the work.

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October 6, 1952.

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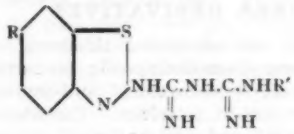
SOME 2-BENZOTHIAZOLYL BIGUANIDES AS POSSIBLE ANTI-MALARIALS

As a part of extensive programme of research, in the chemotherapy of malaria, that has been undertaken in our laboratory to study the effects of different substitutions at either end of the tautomeric biguanide structure, a number of biguanide derivatives having the heterocyclic ring, benzothiazole, attached to the end nitrogen atom of N'-aryl biguanides have been made. In earlier attempts to study the anti-plasmodial activity of compounds, changes have been brought about by the replacement of the sub-

stituents in the paludrine molecule by introducing various pyridyl,[1] quinolyl,[2-4] phenanthryl[5] and acridyl[6,7] rings in place of either p-chlorophenyl group or isopropyl group of paludrine. Excepting a few, almost all of these compounds proved to be inactive when tested against experimental malaria using different plasmodia.

Benzothiazole derivatives[8-14] having various substitutions at different positions are being tried since long, for their chemotherapeutic properties. 1-(2-benzothiazolyl)-2-thiourea was found to possess a quinine equivalent of one when tested for suppressive activity against duck malaria.[15] It, therefore, appears that proper substitutions at the proper places in benzothiazole are likely to produce potential chemotherapeutic agents.

In view of the immense possibilities now being offered by the biguanide structure, it was considered to be of interest to synthesise and study the anti-malarial properties of the compounds possessing the heterocyclic ring and the essential features of paludrine, and as such compounds of the type A have now been synthesised.



Type A

R = H, Cl, CH_3 or CH_3O
R' = Various aryl groups

Compounds of the above type will offer tautomeric possibilities which are said to be responsible for anti-malarial activity of the compound. It will also be noticed that the benzothiazole nucleus can be considered structurally related to the therapeutically active quinoline nucleus in a way where two $-CH=$ groups are replaced by a sulphur atom and also that the nuclear nitrogen atom is in *para*-position to the methoxy group (as in one particular type) as in plasmochin or atebrin; the only difference being that the new 'conductophoric' group has been introduced into 2-position of the heterocyclic part of the ring.

For the synthesis of the compounds of type A as noted below, a number of routes could be suggested, but the most practical and direct one which was successfully employed consisted in reacting the 2-aminobenzothiazolyl hydrochloride with the appropriate arylcyanoguanidine in suitable solvents. The biguanides were isolated as stable crystalline monohydrochlorides with low solubility in alcohol or acetone. The free base was isolated by treating the hydrochlorides with dilute sodium hydroxide solution, which were purified by recrystallisation from dilute alcohol.

Compounds of Type A

No.	R	R'	M.P. °C.	
1	H	C_6H_5-	104-5	Base
2	H	*p*-ClC_6H_4-	198-199	HCl
3	H	*p*-$CH_3OC_6H_4$	193-194	HCl
4	H	*p*-$CH_3C_6H_4$	128	Base
5	Cl	C_6H_5-	196-198	HCl
6	Cl	*p*-ClC_6H_4	206	HCl
7	OCH_3	C_6H_5-	195	HCl
8	OCH_3	*p*-ClC_6H_4-	199-200	HCl
9	OCH_3	*p*-$CH_3C_6H_4-$,	124-125	HCl
10	CH_3	*p*-ClC_6H_4-	203-204	HCl
11	CH_3	*p*-$CH_3C_6H_4-$	194-195	HCl
12	CH_3	*p*-$CH_3OC_6H_4$	187	HCl

On testing some of the compounds of the above series for their suppressive activity against *gallinaceum* malaria in laboratory-bred-chicks, none showed any activity against chick malaria.

The authors' thanks are due to Dr. S. S. Guha and Dr. A. C. Roy for their interest in this investigation.

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SUBSTITUTED HYDRAZODICARBONAMIDINES

As a result of the study of several types of biguanides Rose[1] concluded that a chlorophenyl residue, associated but not necessarily in conjugation with an amidine or extended amidine system, and in a structure that provides

the necessary cationic functions, will more often than not, lead to an active agent. Previously, Thiele[2] had prepared hydrazo-dicarbonamidine nitrate and the base[3] and had suggested that substituted compounds of the same, may be formed by the action of cyanamides on hydrazine.[3] Since hydrazine possesses distinctive physiological properties and some of its derivatives are therapeutic compounds of high stability and low toxicity,[4,5,6,7] and bearing in mind the fact that the amidine systems of themselves have shown high anti-malarial activity,[8] it was thought of interest to synthesise and study the pharmacological action of the substituted hydrazodicarbonamidines.

Accordingly, compounds of the types A and B have been synthesised, by reacting the respective cyanamides, prepared by a modification of Pierron method[9] with hydrazine sulphate, hydrazine hydrate and phenyl hydrazine, in equimolecular proportions in pyridine medium and refluxing over a small flame for 8-10 hours. The compounds in Table I were isolated as their sulphates and were recrystallised from water and those in Table II were isolated as their free bases and were recrystallised from water.

TABLE I

R.NH.C(=NH)–NH.NH–C(=NH)–NH.R .. Type A

S. No.	R	M.P. °C. (Uncorrected)
1	$-C_6H_5$	225
2	$-p$Cl.C_6H_4	183–84
3	$-p$Br.C_6H_4	113
4	$-p$I.C_6H_4	207
5	$-o$.CH_3 C_6H_4	204
6	$-p$$CH_3$·$C_6H_4$	177
7	$-p$$OCH_3$.$C_6H_4$	244 *d.*
8	$-m$$NO_2$·$C_6H_4$	288
9	$-p$.$NO_2C_6H_4$	218
10	$-(C_2H_5)_2$	191–192

TABLE II

R.NH.C(=NH).NH.NH.R .. Type B

S. No.	R	R′	M.P. °C (Uncorrected)
1	$-p$Br.C_6H_4	$-C_6H_5$	151
2	$-p$Br.C_6H_4	$-$C(=NH).NH.R	175 *d.*
3	$-p$I.C_6H_4	$-$C(=NH).NH.R	218

The compounds are awaiting pharmacological investigations as possible anti-malarials and full particulars of the present work will be published elsewhere. The authors' thanks are due to Dr. B. H. Iyer for his keen interest in the work.

Dept. of Organic Chem., Indian Inst. of Science, Bangalore-3, *October* 24, 1952.

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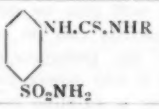
METANILAMIDE SUBSTITUTED THIOUREA DERIVATIVES

SIMPLE as well as substituted thioureas are known to possess chemotherapeutic properties, like anti-bacterial,[1] anti-mycotic,[1] anti-thyroid[2] and anti-tubercular[1,3,4] activities. Considering the anti-malarial[5,6] and anti-bacterial[7] properties of metanilamide and its derivatives and bearing in mind the chemotherapeutic properties of thioureas, it was thought worthwhile to

TABLE I



No.	R	M.P.
1	H–	164 to 166·5°
2	C_6H_5–	161·5°
3	p–Cl.C_6H_4–	162·5 to 163°
4	m–Cl.C_6H_4–	181 to 182°
5	p–Br–C_6H_4–	168·5°
6	p–I.C_6H_4–	186°
7	p–CH_3.C_6H_4–	160·5 to 161°
8	p–CH_3O.C_6H_4–	155·5 to 156°
9	p–$(CH_2)_2C_6H_5$	155·5 to 157°
10	m $(CH_2)_2C_6H_5$–	155 to 155·5°
11	α–$C_{10}H_7$–	170°
12	CH_2=CH.CH_2–	142 to 143°
13	CH_2–	156·5 to 157°
14	$(CH_3)_2CH$–	154°

synthesise a series of alkyl and aryl substituted thiocarbamido derivatives in the N^3-position of metanilamide (Table I) for studying their chemotherapeutic properties.

Accordingly, the compounds tabulated below have been prepared by reacting a solution of the corresponding isothiocyanate in alcohol with a warm alcoholic solution of metanilamide, keeping the reaction mixture for 12 to 24 hours at laboratory temperature, filtering the solid, washing with cold alcohol and recrystallising the product from alcohol or dilute acetone.

Full details of the methods of preparation and pharmacological data will be published elsewhere.

Our thanks are due to Dr. B. H. Iyer for his keen interest in this piece of work.

Dept. of Organic Chem., K. V. VISWANATHAN.
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October 24, 1952.

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PHOTOPERIODISM IN SUNNHEMP C12 *CROTALARIA JUNCEA* L.

APART from yielding a good quality fibre Sunnhemp (*Crotalaria juncea* L.) is believed to enrich the soil in nitrogenous compounds, for which it is sometimes used as green manure to improve poor paddy lands. An investigation of the flowering behaviour of the plant with reference to the daily light period was undertaken. Singh, Kapoor and Choudri,[1] and Singh and Choudri[2] noted that the plant thrives best in 12 hours light period.

Sunnhemp C12 grows best in Calcutta when sown in May-June. Seeds obtained through the courtesy of the West Bengal State Agriculture Department were sown on 21-5-1951 in earthenware pots. Treatment was started four days later just after the cotyledons had unfolded. There were 5 treatments at 8, 10, 12, 14 and 16 hours of light per day. For light periods shorter than the normal day length, the pots were removed to a ventilated dark chamber at appropriate times and allowed to remain there until dusk. The additional light periods were supplied from a 100 C.P. electric bulb at a distance of 1 meter, in case of longer light period treatments. Controls were maintained under natural conditions.

The following results were obtained and are given in a table expressing the mean of the readings for 12 plants per treatment. Flowering time is the time taken for the initiation of the first visible flower-bud, and the fruiting time, the appearance of the first visible fruit. In addition, the total height of the plant and the circumference at the base of the stem on the flowering day were noted separately for each plant.

Treatment	Mean height at flowering in cm.	Mean flowering time in days	Mean fruiting time in days	Basal circumference (mean) of stem in cm.
8 hrs.	52·26	73	83	0·9
10 hrs	45·84	37	48	0·9
12 hrs.	35 3	33	45	1·3
14 hrs.	254·1	131	143	6·3
16 hrs.	153·76 (On 13th December, *i.e.*, after 202 days)	No flowering	..	3·0
Control	216	109	125	5·95

It is thus found that Sunnhemp C12 is a short-day plant, flowering early under 12 hr. and 10 hr. Light periods longer than 12 hr. produce a prolonged vegetative phase. Under 16 hr. however, growth was rather poor and the plants continued to be vegetative till the middle of December when they dried up. The daily light period of nature for the controls gradually increased from 13 hr. 20 min. on May 25th to 13 hr. 31 min. on June 22 and again fell gradually to 12 hr. 3 min. at the time of flowering.

The author's thanks are due to Dr. J. C. Sen Gupta for his interest in the work.

Botanical Laboratory, SUMITRA TALUKDAR.
Presidency College,
Calcutta,
July 7, 1952.

1. Singh, B. N., Kapoor, G. P. and Choudri, R. S., *Proc. Ind. Acad. Sci.*, 1938, **7**, 143-60. 2. Singh, B. N. and Choudri, R. S., *Trop. Agric.*, Trinidad, 1938, 15.

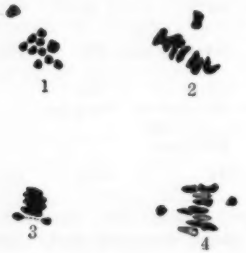
CHROMOSOME BASIS OF DIOECISM IN *TRICHOSANTHES DIOICA* ROXB.

Trichosanthes dioica Roxb., commonly known as *Parwal*, is extensively cultivated as a vegetable crop in Bihar and adjoining States. The sexes,

in this species, are on separate individuals, i.e., some individuals will be male, bearing only staminate flowers, whereas other individuals female, bearing only pistillate flowers. Thus this is a typical dicœcious species.

Banerji and Das[1] studied the development of microspore in this species. They could not find any evidence as to the presence of sex chromosomes in mitotic as well as meiotic divisions. They reported somatic chromosome number as $2n = 22$ in both male and female plants.

The meiotic studies reveal that at I metaphase, eleven bivalents are clearly seen (Figs. 1 & 2). In a large number of pollen mother-cells, one of the bivalents was seen lying away from the rest of the bivalents (Figs. 1 & 2) and was in a different plane. It also took a deeper stain. Of the other ten bivalents which tend to remain in a group, one bivalent was the biggest of the lot, also taking a deeper stain (Fig. 1).



FIGS. 1 to 4. Meiosis in *Trichosanthes dioica*.—Fig. 1, I Metaphase (polar view), showing eleven bivalents, of which one is seen lying away from the rest, in a different focus. Note that one of the bivalents, lying in the group is the biggest, × 1500. Fig. 2. I Metaphase (slanting view), showing eleven bivalents, of which one is seen lying away rom the rest, × 1500. Fig. 3. I Anaphase (early), showing the early separation of one of the bivalents, × 1500. Fig. 4. I Anaphase, showing that one of the bivalents has separated earlier, × 1500.

Anaphase stages (Figs. 3 & 4), clearly indicate that one of the pairs pulls apart earlier and the chromosomes move much ahead than in the case of the rest of the bivalents. It seems from the critical examination of the anaphase that the heteromorphic chromosomes which commonly indicate the presence of sex chromosomes are absent; however, the unusual behaviour of one pair of chromosome at I metaphase and I anaphase strongly suggests that this pair, in spite of having morphologically identical chromosomes, is physiologically different from the rest of the bivalents and presumably possesses sex determining genes.

Of the other species of *Tricosanthes*, worked out cytologically, *viz.*, *T. anguina* (Banerji and Das[1]), *T. japonica* (Sinoto[2]) and *T. cucumeroides* (Yamaha[4] & S.), quoted from Darlington and Janaki Ammal,[2] the presence of sex pair of XY type has been reported in *T. japonica* only.

My sincere thanks to Dr. R. H. Richharia, Economic Botanist to Government of Bihar, for helpful discussions during the course of this study as well as for giving necessary facilities to work.

Botanical Section, G. I. PATEL.
Sabour,
August 12, 1952.

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FOOD PLANTS OF THE DESERT LOCUST

WITH reference to earlier reports[1,2,3] on the food plants of the desert locust, experiments conducted by the present writer both under field conditions and in the laboratory show that the following is their order of preference in regard to plants as food material: (i) paddy, bajra and juar, (ii) mango (*Mangifera indica*), (iii) neem (*Melia azadirachta*), (iv) jamun (*Eugenia jambolana*), and shesham (*Dalbergia sissa*). The locusts do not feed on anjeer (*Ficus carica*), and sharifa (*Anona* sp.). It would thus appear that the desert locusts might in course of time become a serious threat to mango plantation in India.

The locusts under observations belonged to both sexes. The females were put in cages with different grades of hardness in soil. This experiment revealed that forced egg-laying is not a remote possibility in locusts under adverse conditions. Clusters of eggs were found on the food plants, as well as on the surface of soil if the latter is impenetrable for the ovipositor.

Entomology Section, S. MASHOOD ALAM.
Zoology Dept.,
Muslim University,
Aligarh,
August 28, 1952.

1. Husain, M. A. and Mathur, C. B., *Ind. Journ. Ent.*, 1946, **8** (2), 141. 2. Lal, K. B., *Curr. Sci.*, 1951 **20** (6), 165–66. 3. Sen, N. N., *Ibid.*, 1951, **20** (9), 252.

VEGETABLE EXTRACTS AND MALE TOAD REACTION

JAMES T. BRADBURY[1] has produced ovulation in rabbits by injecting various plant juices like those of oats, corn, alfalfa, carrot-top and lawn-grass cuttings. Similarly, we were able to produce emission of sperms by the toad *Bufo melanostictus* by injecting various vegetable extracts.

The vegetable product was ground with distilled water and filtered through ordinary filter-paper. The clear fluid thus obtained was injected into male toads whose cloacal fluids were examined and found negative for sperms. The injections were done subcutaneously with an initial dose of 10 c.c. followed by two injections of 5 c.c. each after an interval of 30 to 45 minutes or even more sometimes.

Extracts of lawn-grass (*Cynodon dactylon*), carrot leaves, alfalfa (grown at Bangalore) skinned, soaked Bengal gram seeds, cabbage leaves and paddy straw produced emission of sperms in the male toad. Paddy straw and cabbage leaves produced positive reaction only when injected fresh. We used 100 grams of vegetable product with 100 c.c. of distilled water. If the vegetable product is fresh and juicy, the extract will be concentrated. If it is dry, the extract will be diluted. In our experience we found that vegetable extracts are to be used only in dilute conditions. Even then alfalfa and carrot-top were toxic in higher doses. Of these, we were able to inject only 10 c.c. and that too, often in split doses of two or three c.c.'s each with a few minutes' interval. With 10 c.c. we were able to get positive reactions.

Wheat bran, rice bran, Bengal gram husk and bone-meal (not a vegetable product) also produced positive reaction in the male toad. They were left in the frigidaire overnight, each 100 grams with enough distilled water to soak through and get filtered. The next morning the fluid was filtered, and injected into toads to get positive reaction.

Whatever be the active principle in these extracts and bone-meal that is able to evoke the male toad reaction, it is very peculiar in not being destroyed while passing through the digestive tracts of various farm animals and laboratory animals like guinea-pig. We fed a non-pregnant female and a male guinea-pig with different diets consisting exclusively of cabbage leaves, lawn-grass (*Cynodon dactylon*), soaked skinned Bengal gram seeds and alfalfa. We collected the fæces the next morning and with the fæcal extracts we were able to produce emission of sperms in the male toad. The dung of breeding bulls fed on alfalfa and other feeds and the dung of bullocks fed on paddy straw produced positive reaction in male toads. Dung of buffaloes—pregnant and non-pregnant, dung of cows—pregnant and non-pregnant, dung of asses—pregnant and non-pregnant and jack-ass, dung of jutka ponies—male and female and fæces of ram, all produced positive male toad reaction when the animals were fed mostly with grass. Hence we have to conclude that the reaction of the fæces of various animals is the same as the reaction of the food the animal eats.

Recently, Bhaduri[2] has suggested the use of fæcal extracts for diagnosing pregnancy in farm animals. His claims were that a positive reaction in the male toad proved the pregnancy of the animal. More recently Krishna Rao and Krishnamurthy[3] failed to get the same results. They found that fæcal extracts of pregnant cows, non-pregnant cows, sterile cows, bullocks, she-buffaloes and he-buffaloes, all produced positive results. Our findings clearly indicate that the positive result is due to the food the animal eats.

Fæces of a ram and a bull even after boiling with distilled water, when filtered and injected, produced positive reaction in the male toad. The active principle therefore, seems to withstand heat.

Further details will be published elsewhere.

Grateful thanks are due to the Principal and the Staff of the Animal Husbandry, Chemistry, Bacteriology and Biology Departments of the Madras Veterinary College for their valuable help.

Dept. of Biology, Madras Veterinary College, Madras, *September* 9, 1952. MRS. K. HARRIS.

1. Bradbury, J. T., *Amer. Jour. Physiol.*, Nov. 1944, **142**, No. 4. 2. Bhaduri, J. L., *Presidential Address to Sec. on Zool. and Entom.*, *38th Ind. Sci. Congress*, 1951. 3. Krishna Rao, N. S., and Krishnamurthy, H. V., *Curr. Sci.*, **1952, 21**, No. 7, pp. 196-97.

SOME NEW BACTERIAL DISEASES OF PLANTS

BACTERIAL diseases produced by three new organisms are described in this note:

(1) *Xanthomonas melhusi* nov. sp., Patel, Kulkarni and Dhande. The pathogen produces numerous, angular (quadrilateral), water-soaked translucent spots measuring 0·5 to 1 mm. On drying, the spots become brown to

deep brown and raised on the upper surface due to accumulation of bacterial ooze. Several spots coalesce to form large lesions.

Description of the Pathogen.—Short rods measuring $2{\cdot}1 \times 1{\cdot}08\,\mu$; gram negative; no spores; capsulated; on potato dextrose agar plates, the colonies are pulvinate, circular with entire margins measuring 1·5 cm. in diameter after 10 days, colour empire yellow (R) with no striations; gelatin liquefied; starch hydrolysed; casein digested; milk peptonised; litmus reduced; ammonia and hydrogen sulphide produced; acid but no gas from dextrose, sucrose and lactose; no growth in salicin; optimum temperature for growth about 28° C., thermal death point near 51° C.; pathogenic to *Tectona grandis*; observed at Ambernath (Bombay State) in October, 1950.

(2) *Xanthomonas erythrinæ* sp. nov., Patel, Kulkarni and Thirumalachar.

On the leaf, the pathogen produces numerous, angular, water-soaked specks which later become brown in colour and are surrounded by a halo which measure 0·5 to 1·0 mm. The spots are raised in the centre on the under surface of leaves and are flat on the upper surface. The veins are infected and appear in some cases to be raised on the upper surface. Infection is more towards the leaf-edges. As a result of severe infection, the leaflet becomes chlorotic.

Description of the Pathogen.—Short rods measuring $1{\cdot}6 \times 1{\cdot}1\,\mu$; gram negative; no spores; capsulated; on potato dextrose agar, the colonies are pulvinate, round, glistening, butyrous, with no striations and entire margins, 1·6 cm. in diameter after 10 days, colour lemon chrome (R); gelatin liquefied; starch digested; casein hydrolysed; milk peptonised; litmus reduced; ammonia and hydrogen sulphide produced; acid but no gas from dextrose, sucrose and lactose; no growth in salicin; optimum temperature for growth 28° C., thermal death point near 51° C., pathogenic to *Erythrina indica*; noticed at Patna (Bihar) in November, 1951.

(3) *Xanthomonas trichodesmæ* sp. nov., Patel and Kulkarni.

The pathogen produces small, round, water-soaked spots all over the leaf. Later on, these enlarge in size and measure 0·5 to 1 mm. in diameter. They are jet black in colour and raised on the upper surface, the corresponding area on the lower surface of leaves becoming depressed. Veins are often infected. Bacterial ooze in the form of shining scales is found on the spots on the lower surface.

Description of the Pathogen.—Short rods: $2{\cdot}2 \times 1{\cdot}3\,\mu$; gram negative; no spores; capsulated; on potato dextrose agar plates the colonies are pulvinate, circular with entire margins and measuring 1·9 cm. in diameter after 10 days with striations starting from the centre to the periphery; colour amber yellow (R); gelatin liquefied; starch hydrolysed; casein digested; milk peptonised; litmus reduced; ammonia and hydrogen sulphide produced; acid but no gas from dextrose, sucrose and lactose, no growth in salicin; optimum temperature for growth about 28° C., thermal death point near 50° C., pathogenic to *Trichodesma zeylanicum*; noticed at Chittlenagar, District Sholapur, in November, 1951.

Detailed account will be published elsewhere.

Plant Pathological Lab., College of Agriculture, Poona-5, *September* 19, 1952.

M. K. Patel.
Y. S. Kulkarni.
G. W. Dhande.

BACTERIAL LEAF-SPOT OF *AMARANTHUS VIRIDIS* L.

A bacterial leaf-spot of *Amaranthus viridis* was prevalent in Poona in February, 1952. Minute, round (0·5 mm. in diameter) water-soaked spots surrounded by a halo are formed along the edges of the leaf. These later become dark brown and depressed. The spots often coalesce to form irregular lesions measuring 1·5 to 2 mm. Bacterial ooze may be found in the centre of the spots. Infection spreads to the petiole and tender portions of the stem.

The organism is rod-shaped, $1{\cdot}3 - 2{\cdot}1 \times 0{\cdot}6 - 1{\cdot}3\,\mu$, rounded at both ends, gram negative, capsulated, non-acid fast, single polar flagellate; stains readily with common dyes.

On potato dextrose agar plates, colonies are smooth, shining with entire margins, colour Empire yellow (R), 1·5 cm. in diameter in 7 days. On nutrient agar plates, colonies round, slightly raised, colour primuline yellow (R), diameter 10 mm. in 7 days; milk peptonised; litmus reduced; gelatin liquefied; starch hydrolysed; casein and egg albumen digested; cellulose not utilised; produces acid but no gas in dextrose, galactose, lactose, maltose, sucrose, mannitol and glycerol; salicin not utilised; ammonia and hydrogen sulphide produced; sodium chloride tolerant upto 3 per cent.; Loeffler's blood serum liquefied; nitrates not reduced; no growth in Cohn's and Uschinsky's solutions; fair growth in Koser's uric acid and Simmon's citrate media; best growth at 28° C.; thermal death point 51° C.

Pathogenic on leaves, petioles and stems of *A. viridis*. Since the pathogen differs from that described by Smith[1] on *Amaranthus* sp., it is proposed to name the organism *Xanthomonas amaranthicola* sp. nov.

Detailed account will be published elsewhere.

Plant Pathological Lab., M. K. PATEL.
College of Agriculture, B. N. WANKAR.
Poona-5, Y. S. KULKARNI.
September 30, 1952.

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SELF-INCOMPATIBILITY IN PUMELO (*CITRUS MAXIMA* MERR.)

THE occurrence of self- or cross-incompatibility has been reported in many fruits. In genus Citrus, both types of incompatibility was found by Ikeda[1] and Nagai and Tanikawa.[2] Gardner, Bradford and Hooker[3] have mentioned the case of Victoria pumelo which ordinarily was seedless but produced seeds freely when pollinated by certain other citrus species. Torres[4] found that the pumelo varieties native to Thailand were self-incompatible.

The pumelo varieties grown in India are nowhere reported to be self- or cross-incompatible. The author, however, noticed the presence of self-incompatibility in Chakaiya pumelo growing at the Fruit Research Station, Saharanpur.

With a view to study the percentage of fruit setting and seed formation in self- and cross-pollinated flowers the following treatments were done on two trees of the variety Chakaiya :

1. Bagged for natural self-pollination.
2. Bagged and hand-selfed on the day of anthesis.
3. Emasculated, bagged and cross-pollinated by hand on the day of anthesis.
4. Left unbagged for open pollination.

It was found that no fruit setting took place in naturally selfed and hand-selfed flowers, whereas in cross-pollinated and unbagged flowers (open pollinated) the percentage of setting was 25 and 17·2 respectively. The average number of plump seeds obtained in treatment Nos. 3 and 4 was 79·7 and 63·5 respectively.

Fresh pollen grains of this variety when examined in aceto-carmin revealed viability of a very high order (Average 94·4%). The pistils too were perfect and fully functional, because when cross-pollinated, they produced fruits. Since self-pollination failed to set fruits in spite of the reproductive organs being fully functional, the variety may, in all probability, be a self-incompatible one.

Fruit Research Station, J. P. NAURIYAL.
Saharanpur, U.P.,
October 20, 1952.

1. Ikeda, Tomochika, *Sci. Agric. Soc. Tokyo Jour.*, 1904, 1906, Nos. 60, 63, 70 (Japanese). 2. Nagai, Keizo and T. Tanikawa, *Third Pan-Pacific Sci. Cong. Tokyo, Proc.*, 1928, 1926, **2**, 2023-2029. 3. Gardner, V. R., Bradford, F. C. and Hooker, H. D., 1939, McGraw Hill Book Co., New York. 4. Torres, Juan P., *Philippine Jour. Agric.*, 1932, **3**, 217-29.

A GALL MIDGE (ITONIDIDAE: DIPTERA) PEST OF CASTOR IN INDIA

WHILE working on the insect pests of castor oil plant during 1943-46, a gall fly was noticed for the first time damaging male flowers and young capsules to the extent of 71·5 per cent. Mani[1] described this fly under the name of *Asphondylia ricini* from specimens sent from here. He appended the biological note on the species sent by the author. The fly has been noticed on castor every year doing considerable damage. The other fly known to be associated with this plant is *Camptomyia ricini* Felt. bred out from dried castor stems and bark at Coimbatore (Felt[2]); *Camptomyia* breeds in decaying vegetable matter.

The eggs of *A. ricini* have not so far been noticed. The young maggot is pale-coloured. The older instars are yellow-white and have chitinised mouth parts. The puparium is dark brown, motile, with a pair of spines at the anterior end. Pupation occurs in the capsule; the empty pupal case is seen stuck up in the emergence hole after escape of the fly. The female has an aciculate ovipositor nearly one-fourth length of the body when extruded.

The maggots attack both male flowers and tender capsules. The attack is first noticed in the field during September (when the crop flowers), the peak of infestation being in October-November. From January onwards the attack is on the decline. Male flowers when infested do not open. They remain non-functional and are later shed. One to four maggots are found in each infested capsule, each locule having sometimes more than one maggot. Feeding is done by scraping of the tissues resulting in a gall-like swelling at the seat of attack. The interior of the capsules becomes felty. Infested capsules drop off after the emergence of the fly. Mature capsules with the hard-shelled seed do not suffer any damage.

Observations were made during 1950-51 season on two varieties, *viz.*, H.C. 1 (non-spiny) and H.C. 6 (spiny). The spiny variety showed less infestation, the average percentage of attack being 43·9 while the non-spiny variety has an average attack of 63·6%.

Two ectoparasites *Evanoides ricini* Rao and *Eurytoma* sp. have been found attacking the larval and pupal stages of the pest.

Grateful thanks are due to Dr. Mohd. Qadiruddin Khan, Government Entomologist, for guidance and encouragement.

Entomological Laboratory, Department of Agriculture, Himayatsagar, Hyderabad,
October 20, 1952.

A. S. Rao.

1. Mani, M. S., *Bull. Ent. Res.*, 1947, **38** (3), 439-41. 2. Felt, E. P., *Mem. Dept. Agri., India*, Ent. Ser. 1921, **7**, 23.

AN ABNORMAL FEATURE IN THE LIFE-CYCLE OF *UROMYCES PROEMINENS* (DC) LEV. ON *EUPHORBIA HYPERICIFOLIA* L.

It is a common feature during the rainy season (July-October inclusive) at Agra (Northern India) to observe many plants of *Euphorbia hypericifolia* infected with *Uromyces proeminens*. The rust is autœcious and macrocyclic on this plant and various stages can be observed either simultaneously or at different times during the year.

Careful study in the field and under controlled green-house conditions shows that plants first observed to be infected have pycnial and æcial stages only. These occur on all leaves and are confined to the lower surfaces. The internodes are greatly elongated and the leaves stunted, slightly fleshy and yellow green in colour. Infected plants die much sooner than healthy plants.

Just after the appearance of primarily infected plants, others in the vicinity show scattered uredia and then telia. Later in the season some branches develop on secondarily infected plants which bear æcia resembling those arising from primary infection. Plants artificially infected with urediospores also first develop uredia followed by telia. Later æcia appear on certain new branches, some of which become transformed to witches' brooms.

Systemic dikaryotic mycelium was observed inside nodes, internodes and apical buds of plants showing primary æcial infection. Similar mycelium was also noted in the midrib of the leaves of these plants and in pycnia. In all cases pycnia developed into protoæcia. Aeciospores were binucleate and in chains. Systemic dikaryotic mycelium has also been noted in the æcial shoots of artificially infected plants. The internodes below the leaf inoculated with urediospores were also found to have binucleate mycelium. In this respect *Uromyces proeminens* resembles *Cytospora oleæ*[1] in not having a haploid stage in its life-cycle.

The author wishes to express his grateful thanks to the late Prof. K. C. Mehta and Dr. S. Sinha for guiding the work and to Dr. R. K. S. Wood of the Imperial College, London, for correcting the manuscript.

Botany Department, Agra College, Agra,
August 8, 1952.

S. C. Gupta.

1. Thirumalachar, M. J., *Bot. Gaz.*, 1945, **107**, 74-86.

CYCLISATION OF ETHYL BENZOYLACETATE- AND BENZOYL ACETOACETATE-ANILS USING ACETIC ANHYDRIDE AND SULPHURIC ACID

The synthesis of 4-hydroxy 2-phenyl quinolines, cyclising ethyl benzoylacetate-anils by Conrad-Limpach[1] method, has not been found as successful as that of 4-hydroxy 2-methyl quinolines.[2] Shah and co-workers[3] have explored the Conrad-Limpach synthesis with the ethyl benzoylacetoacetate-anils and have shown that two products are obtained on cyclisation of the anils; *viz.*, 2-methyl 3-benzoyl and 2-phenyl 3-acetyl 4-hydroxy quinolines.

An attempt was therefore made to cyclise ethyl benzoyl acetoacetate-anils by the method,[4] using acetic anhydride and sulphuric acid. Contrary to expectation, only single product 4-hydroxy 2-phenyl quinoline was obtained. It is therefore evident that deacetylation of the anil should have taken place prior to cyclisation, in spite of the presence of strong acetylating agent—acetic anhydride. The method has met with success in cyclisation of ethyl benzoylacetate-anils giving 4-hydroxy 2-phenyl quinolines in good yields. Further work along these lines with other β-ketonic esters is also in progress. Full details will be published elsewhere.

M. T. B. College, Surat,
November 7, 1952.

B. P. Bangdiwala.
C. M. Desai.

1. *Ber.*, 1887, **20**, 947. 2. *Ber.*, 1888, **21**, 521; Elderfield, *et al.*, *J. Amer. Chem. Soc.*, 1946, **68**, 1272. 3. *J. Ind. Chem. Soc.*, 1951, **28**, 689. 4. Desai and Bangdiwala, *Curr. Sci.*, 1952, **21**, (9), 256.

THIAMINE, RIBOFLAVIN, NICOTINIC ACID AND VITAMIN C CONTENTS OF PALM GUR

In continuation of an earlier note[1] studies on the retention of vitamins in samples of palm gur are reported here. Estimation of the four vitamins was carried out by chemical methods. Vitamin C was estimated by the titrimetric method[2] using 2 : 6-dichloro phenol-indophenol dye. Thiamine was estimated by the thiochrome method,[3] nicotinic acid by the cyanogen bromide method[4] and riboflavin by fluorimetric method.[5] The samples used in present study were palmyrah and date-palm variety.

TABLE I

Vit. C mg./100 g.	Thiamine µg./100 g.	Riboflavin µg./100 g.	Nicotinic acid mg./100 g.
Palmyrah variety			
27·2	21·6	429	3·98
12·0	10·7	379	3·85
27·5	19·5	461	3·13
14·5	26·2	394	4·68
11·1	29·9	448	3·61
30·3	23·9	454	5·12
14·4	25·9	434	5·12
7·3	20·9	386	4·08
25·8	15·5	494	4·83
11·2	14·9	490	4·28
25·4	14·2	482	4·06
16·8	20·7	353	3·58
9·4	20·6	380	4·05
25·9	19·0	364	3·58
33·0	24·1	414	4·68
Date-palm variety			
5·6	18·5	438	4·41
5·2	21·1	429	4·50
14·4	18·2	460	4·06
30·0	29·6	433	4·09
26·6	26·5	448	3·98
28·1	22·6	420	3·92

The table indicates that the two varieties do not differ much in their vitamin contents. Thiamine, riboflavin and vitamin C are known to be very sensitive to high temperature and alkaline pH and it is surprising to find that these are fully retained in the samples of palm gur in spite of the method used for their manufacture (namely heating in an open pan at an alkaline pH and at 110-20°). Of the possible protective factors which stabilize the three vitamins, sulphydryl compounds, which have been shown to prevent oxidation of vitamin C[6] in Neera were found to be absent in palm gur samples. Other substances known as 'apparent vitamin C' which reduce the dye have been shown to be present in walnuts, malt-extract, molasses and certain fruit juices.[7,8] The estimation of the so-called apparent vitamin C in palm gur samples was, therefore, carried out by two methods.

1. *Formaldehyde method*[9] : The method consists in estimating first total vitamin C by normal titration with the dye. The true vitamin C is then destroyed by six-minute treatment with 6% formaldehyde at pH 4 to 5 and apparent vitamin C estimated. The difference between two results give true vitamin C.

2. *Use of ascorbic acid oxidase*[10] : The source of enzyme used was coriander leaves extract. The enzyme acts on true vitamin C to convert it into dehydroascorbic acid which does not reduce the dye. Hence the gur solution is treated with boiled coriander leaves extract and titrated after 2 hours to determine total vitamin C. The part of gur solution is treated with unboiled coriander leaves extract and titrated after 2 hours to determine apparent vitamin C. The difference between two results gives true vitamin C. The two methods gave very similar results. It has been found that nearly 40 to 50% of the total vitamin C is present in the form of apparent vitamin C. The nature of apparent vitamin C has not been proved as yet. Further work to study its nature is in progress.

The two varieties of palm gur samples were obtained from the various centres of their manufacture through the courtesy of the Palm Gur Adviser, Ministry of Food and Agriculture, Government of India, New Delhi.

Dept. of Biochemistry, Institute of Science, Bombay,
September 23, 1952.

B. V. HATWALNE.
KAMALA SOHONIE.

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FORMYLATION OF SOME HYDROXYCOUMARIN DERIVATIVES

The introduction of a formyl group in coumarins by the Gattermann reaction has been found to be unsuccessful.[1] Späth and Pailer,[2] however, were able to formylate 7-hydroxycoumarin by Duff and Bills method[3] using hexamethylenetetramine and obtained 8-aldehydocoumarin in

poor yields. Later Rangaswami and Seshadri[4] prepared 7-hydroxy-4-methyl-8-aldehydocoumarin by the same method. Sen and Chakravarti[5] applied the Reimer-Tiemann method to coumarin for the synthesis of 6-aldehydocoumarin.

As the formylcoumarins would be important as starting materials for the synthesis of a number of heterocyclic compounds like furanocoumarins, coumarino-α-pyrones, it was thought of interest to extend the application of Duff and Bill method[3] to other hydroxycoumarins.

Now 5-hydroxy-4-methylcoumarin, 5-hydroxy-4 : 7-dimethylcoumarin, 6-hydroxy-4-methylcoumarin and 7 : 8-dihydroxy-4-methylcoumarin have been successfully formylated by slightly modifying the method of Späth and Pailer.[2] The compounds obtained are presumed to be the *ortho*-hydroxyaldehydes as they gave coloration with alcoholic ferric chloride and have been provisionally assigned the constitutions, 5-hydroxy-4-methyl-6-formylcoumarin, 5-hydroxy-4 : 7-dimethyl-6-formylcoumarin, 6-hydroxy-4-methyl-5-formylcoumarin, and 7 : 8-dihydroxy-4-methyl-6-formylcoumarin respectively taking into consideration the general reactivity of these coumarins. The detailed report will shortly be published elsewhere.

The work is being extended to other hydroxycoumarins and chromones. Application of other methods of formylation to coumarins is also being investigated.

The authors wish to express their thanks to Dr. R. C. Shah, for his keen interest in the work.

Organic Chemistry Labs., R. M. Naik.
The Institute of Science, V. M. Thakor.
Bombay,
October 7, 1952.

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CERCIAPHIS EMBLICA SP. NOV. (FAM. APHIDIDÆ) A NEW APHID PEST ON *EMBLICA OFFICINALIS*

Genus *Setaphis* v. d. Goot (Fam. Aphididæ) is characterized by the presence of a pair of long setæ on abdomen, media once branched and short cornicles. According to the Director, Commonwealth Bureau of Entomology, London, *Setaphis* is preoccupied and hence its species should be referred to *Cerciaphis* which had been sunk in the past. A new species of the genus has been collected by us and is herein described briefly. Its complete description is however to be published elsewhere.

Cerciaphis emblica sp. nov. Alate viviparous female: Average length 1·367 ± ·022 mm. Head flat between bases of antennæ, with antennal bases 0·164 mm. apart. Rostrum: reaching third coxæ. Antennal segments: Average lengths of first 0·0543, second ·0635, third ·345, fourth ·176 mm., base of fifth 0·155 and flagellum ·082 mm. long. Fourth segment with 14-16 circular sensoria and fifth with 1-2 sensoria. Thorax: citrine, drab in fresh specimens and little lighter than head. Legs: femur, apices of tibia and tarsi dark. Average lengths of fore, mid and hind tibiæ 0·509, 0·478, and 0·599 mm. respectively. Fore wings: Average length 2·006 mm. stigma dark, cubitus (or media of American authors) once branched with bands along veins giving smoky appearance. Hind wings: reduced average length 0·430 mm. Anterior margin with a dark band along a feeble vein. Abdomen: malachite green, with short cone-shaped, striate cornicles which are armed with two very small bristles. Abdomen just above cauda provided with a pair of long setæ measuring 0·186 mm. projecting beyond cauda and with short bristle. Cauda not distinct, rounded and with some long bristles.

Apterous viviparous female: Average length 1·514 mm. pale green. Head: Almost flat between bases of antennæ which are 0·171 mm. apart; frontal tubercle almost absent. Eyes: made up of three facets. Rostrum: Average length 0·388 mm. dark apically and reaching third coxæ. Antennæ: Average length of segments in mm. first 0·06, second ·051, third ·357, fourth 0·187, base of fifth 0·165 and flagellum 0·83. Fourth segment with one apical sensoria and fifth with one at the apex of the base. Legs pale except darker tarsæ, roughly imbricate. Average lengths of fore, mid and hind tibiæ 0·357, 0·419 and 0·451 mm. Abdomen: malachite green uniformly oval, but slightly swollen in region of the cornicles.

Host: Heavy infestation of leaves of *Emblica officinalis* which is cultivated for its vitamin C-rich fruits, have been observed at Poona and Anand.

Entomological Laboratory, G. A. Patel.
Dept. of Agriculture, H. L. Kulkarni.
College of Agriculture,
Poona-5,
September 17, 1952.

REVIEWS

Quantum Theory of Matter. By J. C. Slater. (Published by McGraw-Hill), 1951. Pp. xiv + 528.

This book is intended to be a companion volume to the other books by Prof. Slater and collaborators on "Mechanics", "Electromagnetism" and "Introduction to Chemical Physics". "All these together are expected to form a fairly complete treatment, on the intermediate level of difficulty, of most of theoretical physics, with the exception of nuclear theory." However, the book under review is in itself an independent unit and covers a definite field, namely, the fundamentals of quantum mechanics and its application to the physical properties of matter. Prof. Slater uses throughout the Schrödinger method of considering problems in quantum theory. The first chapter deals with the physical principles of De Broglie Waves and Wave Mechanics. The next three chapters contain a discussion of the Schrödinger equation and the general method of obtaining physical results from it. The rest of the book is concerned with the application of wave mechanics to spectroscopy, interatomic forces and chemical, mechanical, thermal, optical, magnetic and electrical properties of matter. A chapter is set apart for the theory of the metallic state.

As is to be expected of an author of the eminence of Prof. Slater, the book is written in a very lucid style, and will be readily intelligible even to a beginner in quantum theory. However, it is not elementary—the more difficult mathematical portions are included in a large number of appendices, covering nearly 80 pages. The book is eminently suitable for being used as a text-book in the M.Sc. classes of our Universities, and it is not too much to say that a thorough knowledge of its contents is a 'must' for every student who wishes to undertake research work in any branch of physics.

G. N. R.

Structural Chemistry of Inorganic Compounds. Vol. II. *Structure and Constitution.* By Walter Hückel. (Published by Elsevier, Distributors, Cleaver-Hume Press), 1951. Pp. x + 441-1094.

Except for the first and the last chapters, the bulk of the second volume is devoted to crystal chemistry, namely, the crystal structures of inorganic compounds, the structure and bonding in silicates and glasses, and the lattice structure of metals and alloys. The usual books on crystal chemistry, are written from the crystallographer's point of view; but Prof. Hückel's treatment is different, inasmuch as it is based mainly on chemical considerations. He assumes a certain amount of background of crystallography, but this is not essential for following the thread of the argument. The idea of coordination forms the main basis, and the various types of structures are explained as arising from variations in valency and ionic radii. Then follows an account of polymorphism occurring in inorganic crystals and the phase theory of such modifications and also an atomic theory based on the crystal structure. The essential relationships between the different structures are illustrated by excellent diagrams which bring out only the necessary details, without encumbering them with superfluous data. In particular, the discussion of the various modifications of silica and of titanium dioxide is the clearest that the reviewer has come across. There is a section on mixed crystals and another on isomorphism and oriented overgrowths.

The chapter on silicates and glasses contains a short but excellent survey of the structures of silicate minerals. The diagram on p. 758 showing the correlation between the layer structures of talc, micas, chlorites and clay minerals is highly illuminative. The theory of the vitreous state occupies a prominent position in the section on grasses. Prof. Hückel is inclined to accept the network theory of glasses as correct, at least in the case of inorganic glasses.

The chapter on metals and alloys deals with a wide variety of chemical topics, such as the structures of metals, intermetallic phases and alloys, the phase diagrams of alloy systems, Hume Rothery's rule, magnetism of metals and alloys, and structures of non-stoichiometric metallic compounds, particularly oxides, nitrides and carbides.

The first chapter in the present volume contains an account of the properties of volatile inorganic compounds in relation to their molecular and crystal structures and the nature of the chemical bonds. The last chapter is concerned with the chemical reaction in inorganic chemistry, in particular, ionic reaction and reactions of solid substances. The book concludes with a brief account of the motivating forces which has led to the various developments in

chemical science and a short review of the present state of affairs.

Prof. Hückel has eminently succeeded in putting inorganic chemistry on a systematic basis, comparable to what is now obtaining in the field of organic chemistry. It is indeed a unique book, and it should be an invaluable addition to the library of every physical or chemical laboratory.

Flora of the British Isles. By A. R. Clapham, T. G. Tutin and E. F. Warburg. (Cambridge University Press), 1952. Pp. 1591. Price 50 *sh.*

Floras written in classical style are always welcome in any country in the world no matter from where they originate. This is especially so for the University under-graduates and post-graduates and also their teachers, not to mention the amateur botanists whose needs are not so exacting. The book under review is an excellently produced treatise and is a worthy modernised successor to John Ray's *Catalogus Plantarum Angliæ et Insularum Adjacentium* (1670) and William Hudson's *Flora Anglica* (1762), the latter being the pioneer in introducing the binomial system of classification. Since then, Bentham's *Handbook of the British Flora* (1858) and Hooker's *Students' Flora of the British Islands* (1870) are the only two works that could be regarded as landmarks in progress of systematic botany of that country. The appearance of this book, therefore, would be received well in most countries, particularly in India where, despite the emphasis on many experimental aspects of botany in University curricula, there is an increasing appreciation of the need for stepping up of standards of imparting education in this field of science, and the authors of this book rightly point out "Taxonomy is now only one branch, though an important and indeed a fundamental branch of botany, and many people who are not primarily taxonomists have need to identify correctly".

The descriptions and keys in this book are precise and well edited and the authors have promised a volume of illustrations in due course which would be a very useful addition to this volume. The arrangement of families is similar to that adopted by Bentham and Hooker and great emphasis has been laid on the evolutionary tendencies in the plant kingdom; thus, the Pteridophyta find a place in the beginning of the book and the book ends with descriptions of Monocotyledones. Certain firm decisions have been taken by the authors in the matter of following the rather popular preference among botanists nowadays in using the small initial letter instead of an initial capital letter when the epithet concerned is derived from a personal name or a noun. This is a move in the right direction. The authors have also judiciously used their discretion in splitting large heterogeneous genera into a number of reasonably homogeneous groups and further they have recognised subspecies where morphologically similar plants differed cytologically, ecologically or in details of geographical distribution.

The reviewer warmly commends this excellently got-up and authoritative Flora to all botanists in this country. T. S. SADASIVAN.

The Action of Hormones in Plants and Invertebrates. Edited by K. V. Thimann. (The Academic Press Inc., New York), 1952. Pp. 228. Price $ 5.80.

Ever since the discovery of Hormones in plants by Boysen-Jensen following critical growth movements by Charles and Francis Darwin, much water has flown under the bridge. The classical researches of Boysen-Jensen, Paal, Seubert and Went to mention a few, have added one more dynamic subject of research and study under the omnibus branch called Plant Physiology. Nevertheless, a comprehensive treatise dealing with all the knowledge that has accrued over many eventful years in this century both in the plant and animal cells has at last been attempted in this treatise. Much of the information as the Editor of this volume points out, was first printed in 1948 as a few chapters of 'The Hormones', Volume I and it has since been revised and expanded to its present size.

The contents of this book afford stimulating reading and it rightly presupposes a fundamental knowledge and interest in what might be called 'Functional Biology'. The three contributors of the chapters on 'Plant Growth and Other Hormones', 'Hormones in Insects' and 'Hormones in Crustaceans' have brought together all the latest research material available in these fields of enquiry and clearly this is the function of such treatises. The various techniques used in the study of these problems are very clearly written and the illustrations and general get-up of the volume are all that is to be desired. The references given are exhaustive, although on a minor point of citation of the names of journals, the authors have not always bestowed much attention in making them conform to conventional methods of abbreviation of titles of International journals. Altogether, this volume would be a most profitable reading to all biologists. T. S. SADASIVAN.

A Hand-Book of Shellac Analysis. By M. Rangaswamy and H. K. Sen. Second Edition. Revised by G. N. Bhattacharya and G. K. Bose. (Indian Lac Research Institute, Namkum, Bihar, India), 1952. Pp. x + 144. Price Rs. 4-8-0.

In bringing out this revised edition, ten years after the first one was published, special care has been taken to include recent information on all aspects of shellac analysis, in particular, the tentative Indian Standard Specifications of 1946 and the A.S.T.M. Standards of 1949 and 1950. Although a general reference has been given to these specifications in the preface, it would have been more appropriate to refer to the actual reference number of each specification when it is quoted in the different chapters. It will help this extensive compilation of standard methods of analysis to be more useful in quoting the original source of the test in each case.

The book is divided into 15 chapters, each chapter being devoted to one important test, which is discussed at some length in order to give the analyst an idea of its real importance. The methods of testing, including the description of apparatus required and the procedure are given in detail and very often in the original wording, in order to render a reference to the original as far as possible unnecessary. These chapters are followed by an appendix of specifications for different grades of lac and shellac varnish, which will be of great assistance to the dealer, purchaser and analyst.

The book is, on the whole, neatly got up with clear diagrams and with very few printing mistakes and is moderately priced. On page 21 in Fig. 4, the container for the extraction cartridge is wrongly indicated as the siphon tube. On page 53, a sketch of the apparatus described for the estimation of orpiment could have been given.

P. B. J.

Soil Chemistry. By M. W. Shawarbi. (Chapman & Hall Ltd., Essex Street, W.C. 2), 1952. Price 32 *sh.* nett.

A book on soils, particularly its chemistry, would appear to the layman a most uninteresting subject in spite of the repeated focussing in recent times of public attention on soils as the provider of the wherewithal for life of practically every living being on this earth. Dr. Shawarbi's book is an exception and is highly interesting. In his preface he very aptly summarises this idea by stating that "The soil is the cradle and burial place of all life". The book deals in a very interesting manner with all aspects of soil chemistry, and contains twenty-six chapters covering over 418 pages. Dr. Shawarbi has drawn frankly from his own experience in the United Kingdom and in Egypt examples to illustrate the several processes explained. A very good description of the chemical and biochemical processes introduces the subject, and is followed by an account of the role of colloid complex in soils, of minor elements, soluble matter in soils and soil solution, soil acidity and time practice, reclamation of alkaline lands, soil formation and soil classification. Finally, there are chapters on aspects of soil fertility, soil conservation, soils and agriculture. A special chapter on the literature of soil chemistry and its use is given to aid the student in his studies. A very selected bibliography and a good index are also included. The book is well planned and ably executed. Printed on good paper in a very attractive manner in a clear bold type it makes reading easy. However, it is very disappointing to find many printer's devils, due no doubt to poor proof reading. On the whole, it is an excellent book, which can be confidently recommended to every one interested in soils.

N. G. C.

Dairying in India. By J. N. Warner. Issued by the Indian Council of Agricultural Research, New Delhi. (Macmillan & Co., Ltd., Calcutta), 1951. Pp. xii + 380. Price Rs. 15.

The appearance of this manual fulfils a long-felt need for a handy text-book dealing with the principles and practice of scientific dairying against the Indian background, and it is bound to be welcomed by all dairy students, technicians and enlightened farmers in the country. The author has admirably compressed in one small manual a wealth of technical knowledge combined with practical information on the subject.

The opening chapter presents copious statistical data relating to cattle wealth and milk production in India, economic value of the cattle-dairy industry and related aspects. Unfortunately, much of the data lose their significance now since they were compiled in 1945 before the partition of the country.

In the course of the next 14 chapters the author has dealt with various topics under the following titles: Management of dairy cattle in health and disease, milk secretion, constituents of milk; nutritive value of milk, dairy chemistry, dairy bacteriology, dairy engineering, common dairy processes, manufacture of

various indigenous as well as Western types of dairy products, maintenance of production records, the economics of dairying and dairy bookkeeping, marketing of milk and co-operative dairying and goats and other animals as milk producers. At the end of the book there are some useful appendices containing feeding schedules for different classes of farm animals, mathematical data for calculations, etc., followed by a bibliography and indices.

While the information provided in the book on most of the topics appears to be fairly comprehensive, one or two important aspects have not received as much attention as they deserve. For example, the subject of dairy bacteriology has been dealt with in a very sketchy and incomplete manner while some of the statements made are at variance with the trends of recent rsearch. Again, in a manual of this kind, some detailed discussion about modern methods of milk distribution, organisation of the industry on co-operative lines, etc., in relation to Indian conditions would have been very appropriate as well as helpful. The inclusion of a glossary of technical terms used in the book would enable readers in understanding such terms as "Zebu", etc. The above are minor points only and do not in any way detract the value of the present manual as being a very instructive and useful guide to the student as well as the practical dairyman in the country. H. L.

Manual of Bacterial Plant Pathogens. Second Edition. By Charlotte Elliott. (The Chronica Botanica Company, Waltham, Mass., U.S.A., Macmillan & Company, Calcutta), Price $ 6.00.

This new edition of the *Manual* brings up to date all available information on the plant pathogenic bacteria. Part I of the book describes pathogens of proved validity and in Part II are listed species which have been reported in the literature as pathogens but whose pathogenic character has not been fully proved yet. Each plant pathogen in Part I is listed with its synonyms, its cultural, morphological, and physiological characters, the disease symptoms it produces, the geographical distribution of the disease, control measures, and important literature citations. Two indices, one for the pathogens and the other for the hosts, are also given. As it is, the book will prove valuable for ready reference to all working on the phytopathogenic bacteria.

In the preface, the author has said that "The nomenclature follows, largely, that of the 1948 edition of Bergey's *Manual*." In view of this statement, it appears surprising, therefore, that the author has retained the binomial *Xanthomonas solanacearum* (E. F. S.) Dowson instead of *Pseudomonas solanacearum* (E. F. S.), the latter being the one appearing in Bergey's *Manual*, 1948. Dowson in 1943 [*Brit. Mycol. Soc. Trans.* 26 (1 & 2), 4-14] first included this pathogen in his new genus Xanthomonas but later shifted it to Pseudomonas in 1949 (Dowson: *Manual of Bacterial Plant Diseases*, Adam and Charles Black, London, 1949), as according to him it resembles Pseudomonas in morphological and cultural characters; this was already done in Bergey's *Manual* in 1948. Even if the author had intended following Dowson's nomenclature, *Pseudomonas solanacearum* should have been the proper name for the brown-rot organism, in view of the facts given above. This, however, is a matter of opinion and does in no way mar the usefulness of the book.

All citations to literature are prior to 1948; possibly some later papers were not available (notably *Indian Phytopathology* and *Current Science*) or the book was sent to press in 1948, as otherwise the author would have come across some recent work on bacterial plant pathogens, particularly by M. K. Patel from Poona.

The book is excellently printed and got up in the best traditions of the Chronica Botanica Company and should be a valuable addition to any plant pathological library. V. P. Bhide.

The Indian Pharmacist, Glass Containers Special Number. The July 1952 issue of the *Indian Pharmacist*, the official organ of Indian Pharmaceutical Congress Association, is a special number dealing with the problems of glass containers for various industries. The proceedings of a symposium organised by the Central Glass and Ceramic Research Institute about the suitability of glass containers made in India and also speeches made by several experts in this field were published in this particular issue of the journal.

The glass manufacturers have so far been interested in the shape of the article rather than quality which is extremely important for storing pharmaceutical preparations. Dr. Atma Ram has rightly stressed that some set standards should be laid down by the All-India Glass Manufacturers' Federation to ensure quality and uniformity of the products with the establishment of a full-fledged national laboratory devoted to the subject of glass, the opportunities offered by the institute should be fully availed of by the industry. There should be proper control on manufacturing operations and

each factory should equip itself with a technical person in order to exercise control and to keep proper data without which it would be difficult to make a proper appraisal of the manufacturing problems and even more difficult for the central institute to help them.

The industry is hampered by the high price of imported soda ash which is the chief raw material. The rebate on soda ash given to the glass industry has been recently withdrawn on the recommendations of Tariff Board. The cost on soda ash makes up a major portion of the expenditure on raw materials of the glass articles and the rebate on customs duty is absolutely essential in the interests of glass industry. This is a useful monograph containing a lot of information for people interested in the development of pharmaceutical, food and cosmetic industries.

B. K. B.

Proceedings of the Bihar Academy of Agricultural Sciences. Vol. I, No. 1. January, 1952. Price Rs. 3-8-0. Annual Subscription Rs. 10.

The Bihar Academy of Agricultural Sciences (Headqrs. at the Agricultural Research Institute, Sabour P.O., Bihar), is to be congratulated on the issue of the first number of its *Proceedings*, published in January, 1952. It is a handsome publication in an attractive orange-yellow cover, printed and published at the Bangalore Press. The *Proceedings* are to be published thrice a year, the annual subscription being Rs. 10.

The issue contains 7 papers, all of which are well written and of considerable scientific value. Four of them pertain to Agricultural Botany, of which one is about studies on the Inter-Varietal Hybridization in *Luffa acutangula*; another is on studies in respect of increasing fruit-yields in Papaya; the third, on 'Size and Shape of Plots in Wheat Trials'; and the fourth concerns Cytological Studies in *Loranthus*. Entomology is represented by a paper on 'Studies in the Production of Carbon Dioxide in Stored Wheat Infested by Grain Weevils'. There are two articles on Soil Chemistry: one, on the 'Determination of Exchangeable Cations in Bihar Soils' and the other is a comprehensive paper based on surveys of Bihar Soils in respect of their manurial requirements. The paper is accompanied by several appendices, in which the results of various observations and experiments are tabulated. The work reported on would appear to be very useful and practical from the cultivator's point of view.

Y. R. R.

Books Received

Theory of Electric Polarisation. By C. T. F. Bottcher. (Elsevier Publishing Co.), (Distributors: Cleaver-Hume Press), 1952. Pp. xiii + 492. Price 70 *sh.*

Electrochemical Data. By B. E. Conway. (Elsevier Publishing Co.), (Distributors: Cleaver-Hume Press, London), 1952. Pp. xviii + 374. Price 55 *sh.*

Anuvil Thandavam (Tamil). By R. K. Viswanathan. (R. K. Viswanathan), 1952. Pp. 220. Price Rs. 3.

Biochemical and Allied Research in India, Vol. XXII for 1951. Published in 1952. Price Rs. 3.

Colloid Science I. By H. R. Kruyt. (Elsevier Publishing Co.), 1952. Pp. xx + 389. Price 70 *sh.*

Data and Circuits. By N. S. Markus and J. Otte. (Elsevier Publishing Co.), 1952. Pp. 11 + 487. Price Rs. 21.

Major Faults on Power Systems. By A. G. Lyle. (Chapman & Hall), 1952. Pp. xvi + 355. Price 45 *sh.* net.

SCIENCE NOTES AND NEWS

Everyday Science—Quarterly Journal of Popular Science

Everyday Science, Vol. 1, No. 1, of which has just now appeared, goes a long way in fulfilling the need for a journal devoted to the dissemination of scientific knowledge among non-specialists. Judging by the excellence of the contributions in it, the North India Science Association, who have sponsored it, deserve our heartiest congratulations. With an Editorial Board which includes such distinguished names as Prof. M. S. Randhawa, Sir S. S. Bhatnagar, Dr. S. L. Hora and many others, we are sure that it will not be long before the journal makes its appearance as a monthly instead of a quarterly as at present.

New Development in Polio Research

Dr. Cox, Director of Virus Research at the Lederle Laboratories, New York, reports that the Lansing type of Polio virus has been modified and caused to grow in chicken eggs. This method is much easier, less costly and it is hoped, will lead eventually to the production

of an effective immunising vaccine for polio. It is, however, stated that no vaccine is now available through this method, nor is it possible to say definitely whether such a vaccine might become a reality for use on human beings.

Titanium-Dioxide Rectifiers

A new type of rectifier recently developed by the National Bureau of Standards promises to be the first major improvement in metal-oxide rectifiers since their introduction in 1926. The new rectifier is composed of a layer of semiconducting titanium dioxide, a sheet of titanium metal, and a counter-electrode of some other conducting metal. Preliminary investigations have shown that the units withstand voltage in the reverse direction reasonably well and that their properties are satisfactory at elevated temperatures. Both the initial development and subsequent detailed exploratory investigations are the work of R. G. Breckenridge and W. R. Hosler of the NBS Solid State Physics Laboratory.

Unimeter

The versatile forestry instrument *Unimeter* was designed and constructed towards the end of the last war to serve the needs of the army for rough and ready use in its varied activities. This simple, multi-purpose instrument may be used as a ghat tracer, abney level, hypsometer, altimeter, clinometer, cross staff, optical square, crown meter, sextant, all in one. Further details are available from Dr. K. Kadambi, Conservator of Forests, No. 3, Forest Research Institute, New Forest P.O., Dehra Dun (India).

J. M. Das Gupta Memorial Medal

Applications are invited for the above Gold Medal for 1952 from chemists of any age. The award will be made on unpublished researches and/or on independent papers published in the *Journal of the Indian Chemical Society* by the candidates during the years 1951 and 1952. No paper for which any other prize, or Degree other than M.A., or M.Sc., has been obtained, will be accepted. Applications together with four copies of each reprint or typewritten paper should reach the Hon. Secretary, Indian Chemical Society, P.O. Box 10857, Calcutta, not later than 31st March, 1953.

UNESCO Guide to Importation of Scientific Materials

UNESCO has issued a 21-page pamphlet explaining the operation of the International agreement on the importation of educational, scientific and cultural materials. The price of the publication is 20 cents.

Award of Research Degree

The Punjab University has awarded the Degree of Doctor of Philosophy in Zoology, to Mr. Karam Singh for his thesis on "The Aleurodidæ) (White Flies) of India and Burma".

Ramsay Centenary Exhibition

An exhibition, organised jointly by the Science Museum and University College, London, is being held from October 2 to January 3, 1953, to mark the centenary of the birth of Sir William Ramsay, C.B., F.R.S., and to commemorate, among other work, the discovery of the inert, or "rare" gases of the atmosphere-argon, helium, neon, krypton and xenon.

Foreign Students' Seminar at MIT

Four Indian students have been invited to attend the Foreign Students' Summer Seminar at the Massachusetts Institute of Technology, U.S.A., to be organised by the United States National Student Association Committee, between June 8 and September 25, 1953, for research in science, engineering, architecture and regional planning. The selected students will have to pay their own passage money both ways. Applications should reach the Ministry of Education, Government of India, New Delhi, on or before January 8, 1953.

NOTICE

All material intended for publication in *Current Science*, corrected proofs, books for review and exchange journals, may please be sent to the Editor:

Professor G. N. Ramachandran,
A. C. College of Technology,
Guindy, Madras-25.

Remittances, correspondence regarding subscriptions to the journal, advertisements and requests for missing numbers, etc., may please be addressed to:

The Manager,
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Current Science, Vol. XXI, 1952

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